the OIL AND GAS JOURNAL

BJ's own API Standard rig located at the main plant duplicates, as closely as possible, actual field conditions. Here every basic design is tested and abused far beyond normal usage before submitting to the field.

LOOK FOR NEW BJ TOOLS SOON

WHAT THE STATEMENT

BJ STANDS FOR ENGINEERED OIL TOOLS

REALLY MEANS TO THE OIL INDUSTRY

Engineered building and repairing of BJ Hooks, Elevators, Links, Tongs, etc., is made possible because:

1 BJ representatives covering every oil field in the world for the past 17 years have accumulated a vast amount of knowledge concerning the requirements for every known condition. This information has in turn been submitted to our staff engineers.

2 BJ staff engineers spend all their time in designing, redesigning and field-testing drilling and production tools to meet constantly changing needs.

3 BJ metallurgists know the meaning of strains, stresses, torque and wear imposed on tools—know the kind and character of material required to meet such punishment, as well as how to heat-treat it for best results.

4 BJ shop equipment and personnel working together produce tools of the design and material that give the industry the greatest return for the investment.

Field experience—tested design—proved metallurgy—good shop practice—these are the components that make the statement "BJ stands for engineered tools" really mean something to the oil industry.

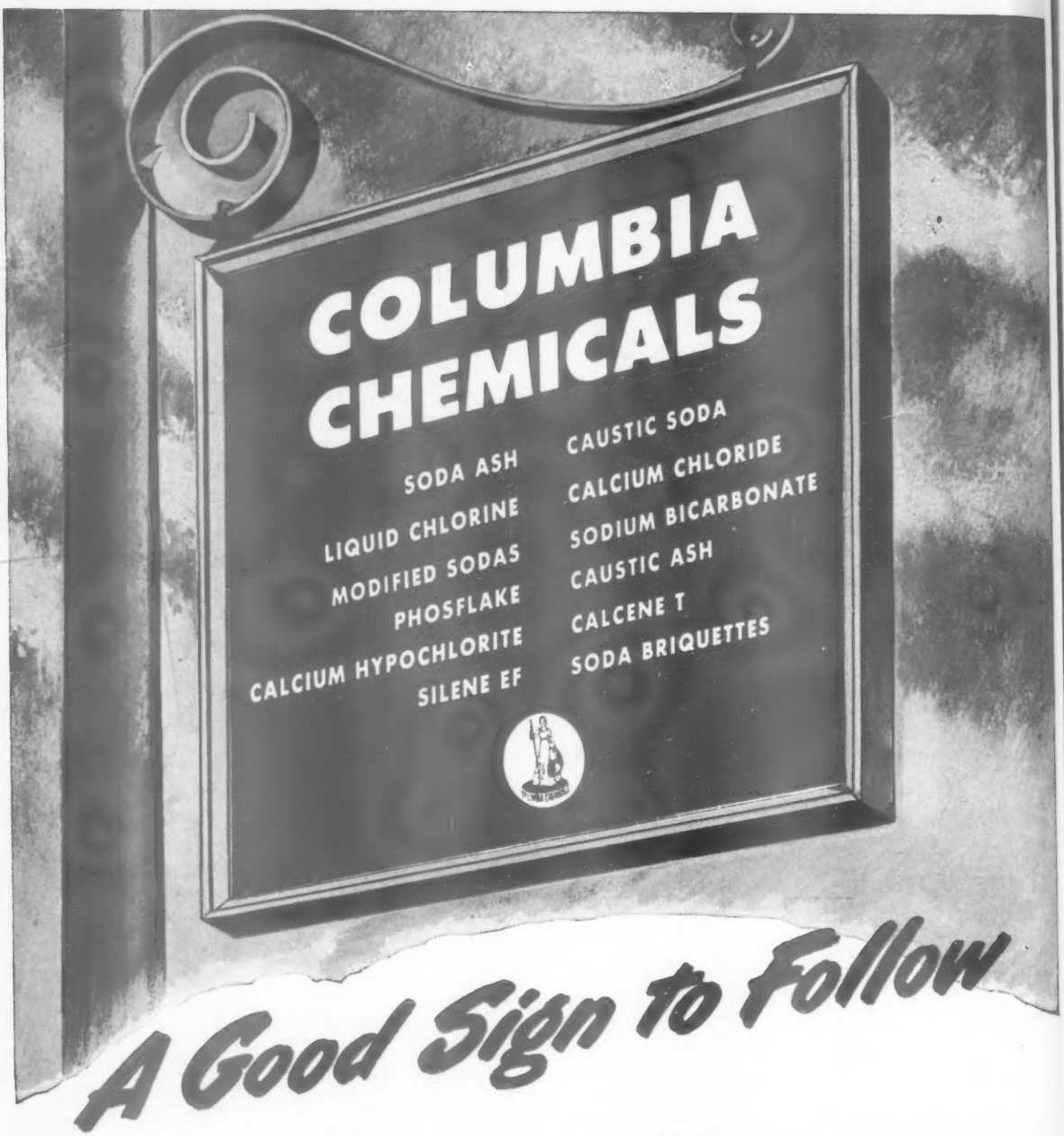
BUY MORE 7TH WAR LOAN THAN BEFORE

ARMY E NAVY

BYRON JACKSON CO.

Houston • LOS ANGELES • New York

PRICE 20 CENTS JUNE 2, 1945



A Good Sign to Follow

Columbia products meet your most exacting requirements . . . Columbia policies contribute to enduring business relationships. Well located plants and excellent distribution facilities are other important factors in the selection of Columbia as your source of alkalies and related chemicals.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
GRANT BUILDING • PITTSBURGH 19, PA.

CHICAGO • BOSTON • ST. LOUIS • PITTSBURGH • NEW YORK • CINCINNATI • CLEVELAND
PHILADELPHIA • MINNEAPOLIS • CHARLOTTE • LOS ANGELES

the OIL AND GAS JOURNAL

published weekly by the

PETROLEUM PUBLISHING COMPANY

211 S. CHEYENNE AVE., TULSA 1, OKLAHOMA

Subscription rate to the petroleum industry, United States and foreign, 1 year, $6.00; 2 years, $10.00; 3 years, $12.00; 5 years, $15.00. Single copies, 20 cents. Back copies, when over a year old, 50 cents. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879.

Copyright 1945, by The Petroleum Publishing Co.

Vol. 44, No. 4 June 2, 1945

P. C. LAUINGER, *President* — C. O. WILLSON, *Editor*

E. H. ROURKE, *Business Manager* — H. STANLEY NORMAN, *Managing Editor*

R. C. MAC DOUGALL, *Circulation Manager* — ARCH L. FOSTER, *Refining Editor*

W. L. NELSON, *Technical Editor* — PAUL REED, *Pipe-Line Editor*

Associate Editors

LYNN M. NICHOLS — NEIL WILLIAMS

CHARLES J. DEEGAN — KENNETH B. BARNES

R. B. TUTTLE

District Editors

JAMES McINTYRE, Tulsa 1, 211 S. Cheyenne Ave. — THOMAS F. SMILEY, Tulsa 1, 211 S. Cheyenne Ave.

TOLBERT R. INGRAM, Denver 2, State Office Bldg. — E. H. SHORT, JR., Houston 2, Sterling Bldg.

HENRY D. RALPH, Washington 4, Natl. Press Bldg. — L. P. STOCKMAN, Los Angeles 14, Union Oil Bldg.

A. C. MacINTYRE, Oil City, Derrick Bldg. — O. C. PRESSPRICH, Saginaw, News Bldg.

VICTOR LAURISTON, Chatham, Ont., 35 Stanley Ave. — FABIAN R. STALEY, New York 17, 415 Lexington

Advertising

E. KLAPPENBACH, *Vice President*

KENNETH J. LANGLEY, *Eastern Manager*, New York 17, 415 Lexington Ave. — CRAIG ESPY, *Pittsburgh Manager*, Pittsburgh 19, Grant Bldg.

C. R. FARMER, *Chicago Manager*, Chicago 2, 105 W. Madison — J. HOWARD TINKHAM, *California Manager*, Los Angeles 15, 1400 S. Grand Ave.

WAYNE RIVES, *Gulf Coast Manager*, Houston 2, Sterling Bldg. — A. J. CHAMBERS, Beckenham, Kent, England, 31, The Avenue

MITCHELL TUCKER, *Manager, Research Dept.*, Tulsa 1, 211 S. Cheyenne Ave. — JOHN D. REILLY, *Production Manager*, Tulsa 1, 211 S. Cheyenne Ave.

Member
Audit Bureau of Circulations
Associated Business Papers

Table of Contents

NEWS DEVELOPMENTS

House Passes Bill Which May Result in Lower Import Duty . . 52
New Attorney General's Reputation for Fairness Encouraging 52
Holman Sees Cloudy Days Ahead for Oil Industry 53
California Standard Denies NLRB Findings 53
June Production Rate Lowered 6,380 Bbl. from All-Time High 54
Oil and Gas to Have Important Roles in Nylon-Salt Plant 54
David Elected to Succeed Taylor as Shell Official 54
"Operation Pluto" Fed Oil to Allied Armies in Europe 56

Trends 51
This Week 55
Editorial 59
Deaths in the Industry 64
Natural-Gas News 108
Natural-Gasoline News . . 108
Refining News 109
Pipe-Line News 112

ENGINEERING AND OPERATING

What Others Say—Technical Training of Service Men 66
Fullerton Pool Guidepost in Clear Fork and Devonian 69
Fluorochemistry in Petroleum Science 75
Substantially Built Pipe-Line Tool 80
T.C.C. Process for Motor-Gasoline Production 84
Mechanics of Production Series—No. 30—Invasion Factors and Patterns 97

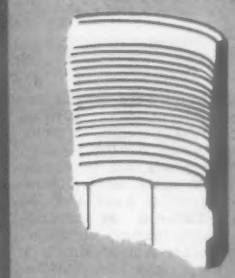
Questions on Technology . . 83
Books 102
Eng. Fundamentals 105
The Refiner's Notebook . . 107

EXPLORATION AND DEVELOPMENT

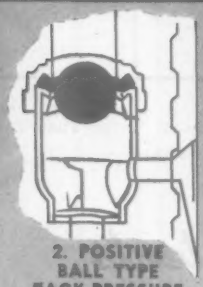
Week's Highlights 115
Completions in All Fields 115
Daily Average Production for Week 116
Reports by Areas Start on Page 116
Wildcat Completions and Discoveries 129

ADDITIONAL FEATURES

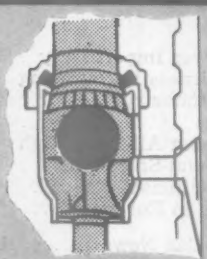
Market Summary 129
Crude-Oil Prices 129
Drilling Contractors 130
Events on the Calendar . . . 131
Personals 132
Men in Equipment News . . 134
Classified Advertising 135
Index of Advertisers 138



1. STRENGTH

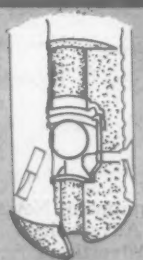


2. POSITIVE BALL TYPE BACK-PRESSURE VALVE



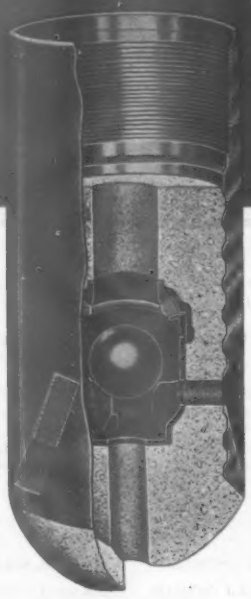
3. AMPLE CIRCULATION AREAS

4. BAFFLED WHIRLER PORTS



5. EASY DRILLABILITY

Landing & Cementing Casing



PRODUCT 120
Baker Cement Wash-Down Whirler Float Shoe

Do It Right and Do It the First Time With A BAKER CEMENT WASH-DOWN FLOAT SHOE

Here's why the Baker Cement Wash-Down Whirler Float Shoe provides best possible assurance of first-time successful results when landing and cementing casing.

1. *Strength*—The seamless steel casing shoe into which the concrete plug and plastic Ball-Type Valve Assembly are securely anchored, provide a unit that has the *strength* to float the longest and heaviest string of casing with an ample factor of safety.

2. *Positive Leak-Proof Back Pressure Valve.* The buoyant plastic Ball-Type Back-Pressure Valve floats in the cement slurry or rotary mud and instantly forms a leak-proof double seal against a narrow, tough rubber ring (backed by plastic and concrete) at the slightest reversal of pressure.

3. *Ample Circulation Areas.* The correctly designed, streamlined Valve Assembly provides passageways ample for any circulating or cementing operation.

4. *Baffled Whirler Ports.* These whirler ports provide the important wash-down whirler action so advantageous in circulating and cementing operations. When the fluid strikes these baffled ports, a downward and then an upward whirling motion results. In running in, this whirling action provides a means of effectively washing away bridges. During cementing, the whirling action imparted first to the fluid preceding the cement slurry and then to the slurry itself, properly prepares the hole to receive the cement. It then assures best possible distribution of a uniform body of cement around the shoe and the shoe joint, reducing the hazard of channeling to a minimum.

5. *Easy Drillability.* Complete and easy drillability results from the internal construction of Baker Formula Concrete and Plastic . . . the Plastic Ball-Type Valve Assembly being set on end in the concrete plug to present a minimum cross-sectional area to the drilling bit. The concrete and Plastic are quickly and easily drilled up and circulated out of the hole.

BAKER OIL TOOLS, INC.
Houston—LOS ANGELES—New York

the OIL AND GAS JOURNAL

Trends

Crude-Oil Production
By States—Page 116

CRUDE-OIL STOCKS 221,861,000 bbl. as of May 19—up 265,000 bbl. One year ago 234,299,000 bbl.

GASOLINE STOCKS 89,673,000 bbl. as of May 19—down 277,000 bbl. One year ago 87,785,000 bbl.

RESIDUAL FUEL-OIL STOCKS 38,624,000 bbl. as of May 19—down 324,000 bbl. One year ago 50,761,000 bbl.

GAS OIL AND DISTILLATE STOCKS 29,470,000 bbl. as of May 19—up 474,000 bbl. One year ago 31,104,000 bbl.

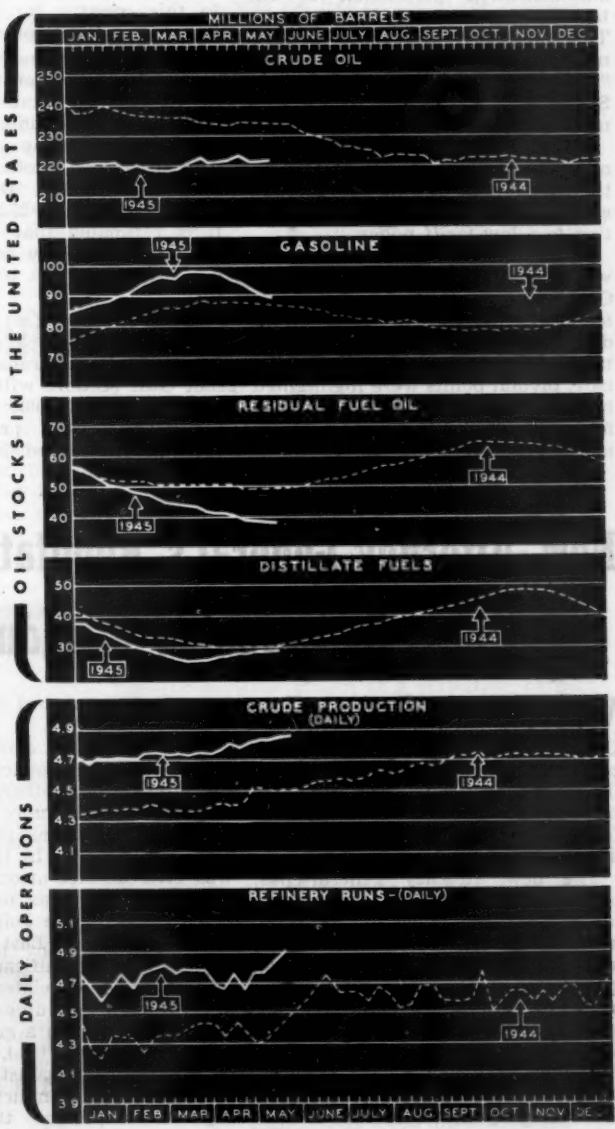
CRUDE-OIL PRODUCTION 4,868,050 bbl as of May 26—up 5,250 bbl. One year ago 4,515,250 bbl.

REFINERY RUNS 4,908,000 bbl. daily week ended May 19—up 58,000 bbl. One year ago 4,513,000 bbl.

RESUMPTION of unfettered commerce in Atlantic and Mediterranean shipping lanes points to early restoration of civilian petroleum traffic between eastern and western hemispheric producing countries and the European continent. Joint action this week by the U. S. and British navies removed convoy regulations from noncombat sealanes, a change in marine operations which will drastically increase efficiency of tankers carrying petroleum and its products from North American, South American, the eastern Mediterranean and ports of western Europe.

ANY guess now on the time required to restore French, Belgian, Netherlands and German refineries to operating status would be premature. Certain, however, is the objective of Allied countries to restore the civilian economy in liberated territory as quickly as possible, thus minimizing relief requirements for food and materials. One development gives a clew to the probable time lag. Kuwait petroleum shipments, presumably in fulfillment of the contract recently negotiated with French refining interests, will be started during the first quarter of 1946. Limited shipments of crude to southern France, Italy, Spain, Portugal and the less severely war damaged refinery centers already are under way and this traffic will be expanded gradually as conditions and facilities permit.

FITTING into the picture of restored petroleum commerce is the availability of tankers and cargo vessels which had been under German direction or in Nazi service for about 5 years. Norway's tanker fleet, for example, was the third largest in the world at start of the world war. In addition to boats accruing to the Allies from the victory over Germany there is the even more important factor of much speedier voyages. Tanker capacities operating under wartime convoy conditions were reduced as much as 75 per cent because of delays in port and the necessity of waiting to rendezvous with escort vessels. The United States military and civilian authorities, of course, are under obligation to make shipments from the Western Hemisphere just as convenient and free of restraint as possible in order to give producers and refiners on this continent competitive positions comparable to those existing in the Middle East.



House Passes Bill Which May Result in Lower Import Duty

WASHINGTON. — The House last week passed the Reciprocal Trade Agreements Act, after defeating an amendment sponsored by Republican members to remove the section permitting additional reductions in tariffs. The bill passed after a stormy session, highlighted by an appeal by President Truman for support of his administration in putting the measure through.

If confirmed in the Senate, the bill will extend the period of United States trade agreements with other countries for 3 years and give the administration permission to cut tariffs an additional 50 per cent. This authority, the State Department has stated, represents needed "bargaining power" for the United States in working out future economic agreements.

Passage in the House represents not only the first step to victory on the major issue testing the Truman administration, but commits the nation to a low-tariff policy.

Typical of debate preceding the vote was a speech by Representative Carlson of Kansas, who urged protection of the United States oil industry for both economic and military reasons. Throughout the debate, pivotal points were highlighted by discussion of the possible effect of the bill upon the petroleum industry.

Quoting Russell B. Brown, general counsel of the Independent Petroleum Association of America, who testified on the bill before the ways and means committee, Carlson reiterated the industry's fear of a flood of imports from South America and the Middle East to compete with United States produced oil.

"Let us keep in mind," Carlson said, "that this nation is the most concentrated market for petroleum in the entire world. We have three passenger cars, trucks and busses for each one outside the United States. It is only reasonable that foreign producers will be looking to this country for a market for their stimulated production.

"The two principal producing areas which threaten the oil market of the United States, if not the world, are the Middle East and the Caribbean. During 1938, South America's oil production totaled 671,625 bbl. daily. During 1944 it had increased to 925,342 bbl. daily. It is estimated that it will reach 1,212,000 bbl. daily in 1945, or an increase of 540,000 bbl. daily over 1938.

"The Middle East production," Carlson said, "which comes largely from the Mediterranean and Persian Gulf section, will produce approximately 1,000,000 bbl. daily in 1945. This area's production has doubled or trebled in the last 4 years."

New Attorney General's Reputation for Fairness Encouraging to Industry

WASHINGTON. — President Truman's nomination of Thomas C. Clark to be attorney general in place of Francis Biddle means that the oil industry can expect the antitrust laws to be enforced firmly and fairly but entirely free from prejudice.

The new attorney general has been in the Department of Justice for 8 years and much of this time he was working with the antitrust laws, so he is more intimately acquainted with this phase of the department's work than any of its other activities. His record in the antitrust division does not hold out any hope to business that he will favor a soft or lax enforcement of the monopoly statutes, but at the same time the record shows a reputation for fairness.

Also, Tom Clark comes from Dallas, where he practiced law with his father and brother, and is well acquainted with many oil men and with the operations of the oil industry in general. In 1932, when he was civil district attorney for Dallas County, he was named master in chancery in the Joiner litigation over titles in the East Texas field.

The most significant comment from Clark's associates is that he never files a suit unless he is convinced that he has a good case and can win in a fair trial. This should be a safeguard against filing "nuisance suits" or conducting "fishing expeditions" under the antitrust laws without complete evidence in advance of bringing the case — a practice which has been charged against the Department of Justice at various times in the past.

Clark's personal record, both before and since joining the Department, shows that he has almost never lost a case which he had prepared. Clark worked in the antitrust division in various capacities, both in Washington and in field offices, from 1937 until shortly after Pearl Harbor, when he was put in charge of enemy alien control in the West Coast area. Later in 1942 he was recalled to Washington and put in charge of the war frauds unit of the criminal division.

When Judge Thurman Arnold resigned as assistant attorney general in charge of the antitrust division Clark was picked as his successor after a thorough review of his record and policies, a circumstance which would indicate that his attitude toward the antitrust laws was not out of keeping with the dominant policy of the administration at that time. In the course of a general reorganization of the Department of Justice late in 1943, Clark traded jobs with Wendell Berge who was then head of the criminal division. Berge became head of the antitrust division while Clark took the criminal division which included the war frauds unit and therefore promised more active court work at the moment. Because of the long association of Clark and Berge, it is not expected that the new attorney general will make any significant changes in the personnel of the antitrust division.

Of the many antitrust cases remaining to be tried as soon as the war is over, one of the largest is the suit in the District of Columbia courts against the American Petroleum Institute and 22 major oil companies. There is nothing in the new appointment to suggest that this case might be abandoned, but there is every reason to expect a completely fair trial.

House Committee Will Check on Oil-Price Study

WASHINGTON. — The House Small Business Committee has scheduled hearings on crude-oil costs and prices for June 12 and 13, it was learned here this week. The purpose of the hearings is chiefly to give the committee a report on the progress of the Office of Price Administration cost study which it recommended last December.

The Patman committee will hear representatives of OPA, the industry crude-oil advisory committee and witnesses from the industry. No list of witnesses has been drawn thus far.

Holman Sees Cloudy Days Ahead for Oil Industy

OKLAHOMA CITY.—"Some hardships and dissatisfactions" await the oil industry in the first year following defeat of Japan, Eugene Holman, president of Standard Oil Co. (New Jersey), said here May 28 at a dinner given in his honor. Holman came to address the graduating class of University of Oklahoma, and he took time to tour the West Edmond oil field. Earlier he was entertained by executives of The Carter Oil Co. and Tulsa oil men.

Decline in requirements for crude and refined products will be the primary cause of troubled days, Holman said in his Oklahoma City talk. "Since this is a subject about which I am supposed to know something, perhaps you might like to have our views as to the postwar outlook.

"Assuming that 1946 represents the first postwar year (which may not be the case)," said Holman, "we believe at present that the demand for petroleum products in this country and including exports will be about 4,150,000 bbl. per day. This would be about 5 per cent below the 1941 demand but nearly 22 per cent below the current demand of 5,300,000 bbl. per day.

"Reflected back into crude production after allowance for imports, natural gasoline production, etc., we believe this will drop from its present level of about 4,800,000 bbl. per day to a little over 3,800,000 bbl. per day or about the 1941 level.

"We believe, however, that after about 2 years there will be a relatively rapid increase in requirements so that by 1950 or 1951 crude production and demand will be back to approximately present levels.

"There is no doubt but that at the present time we are producing crude at a faster rate than is justified by the best practices. In many fields it would be highly desirable to curtail production to some extent. However, if we have to reduce production by 1,000,000 bbl. per day or about 20 per cent below current levels it will undoubtedly produce some hardships and dissatisfaction."

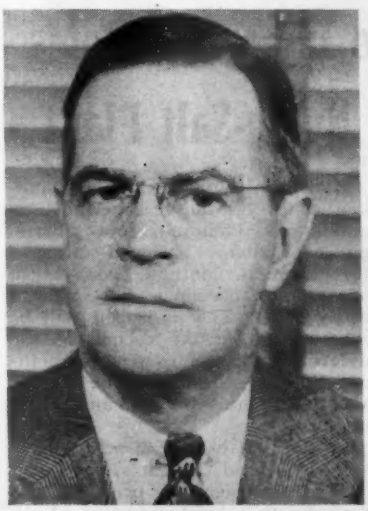
Robbins Named PAW Materials Director

WASHINGTON. — E. E. Robbins, Tulsa, formerly a special representative on petroleum material for United States Steel Export Co., has been named director of the division of materials, Petroleum Administration for War, to succeed Claude P. Parsons, who resigned to resume his duties as vice president of Halliburton Oil Well Cementing Co.

Robbins joined PAW in January 1942, resigning as manager of sales at Tulsa for Oil Well Supply Co., to become director of materials in District 2 at Chicago. He left that post May 31, 1942, to become a chief industrial specialist with War Production Board in Washington. He returned to PAW in January 1943 as a special assistant in the deputy administrator's office, remaining until June 30, 1944, when he joined United States Steel Export Co.

William Howard Collins has been named assistant director of the division of materials to fill the vacancy caused by the resignation of David L. Trax, who rejoined Gulf Oil Corp. in Tulsa, in charge of materials for the production department.

Collins attended University of Texas, went to work as a roustabout for The Texas Co. and became a district superintendent for Shell Oil Co., Inc. He was in business for himself in New Iberia, La., when he joined PAW in 1942. At the time of his recent promotion he was chief of the petroleum equipment manufacturers' section of the division of materials.



E. E. ROBBINS

California Standard Denies NLRB Charges

WASHINGTON.—Standard Oil Co. of California last week denied the National Labor Relations Board findings that the Standard Employes Association is dominated by the company, and announced that it will contest the order, issued May 23, to disestablish the association.

In a prepared statement the company pointed out that the association (S.E.A.) had been a bargaining agent for employes for 11 years, and that it had been investigated, first in 1934 by Department of Labor, and later on four occasions by NLRB. Each investigation was made at the request of the Oil Workers Union. The first investigation resulted in a report that the union was the free choice of the employes, and that they were not dominated. NLRB dismissed the case after each of its previous investigations.

"It is important to note that all these earlier investigations were made at the time the alleged acts were supposed to have occurred, rather than 10 years later, as in the present case," Standard said.

"Our company's various labor contracts with different unions are further evidence that our employes have freely exercised their choice of collective bargaining agents. Particularly is this shown by the fact that employes again chose S.A.E. as their bargaining agent in the election supervised in Richmond last year by NLRB itself.

"We believe that Congress intended through the National Labor Relations Act to give employes the right to choose freely as to what union or unions they want. Because of the long period during which S.E.A. has been the employes' choice, as affirmed by last year's election, and because of the fact that Standard has not dominated or interfered with the employes' free choice of a collective bargaining agent, the company will contest the ruling of the board."

The NLRB order requires Standard to cease the activities objected to as "dominating," to cease and desist from recognizing S.E.A. as representative of any of its employes for collective bargaining, giving effect to existing or superseding contracts with the association, or in any other way "restraining or coercing" employs in forming an organization or joining the Oil Workers Organizing Committee or Oil Workers International Union, CIO.

Recognition is to be withdrawn from the association, and a notice posted throughout the various plants for 60 days stating that the association has been disestablished.

June Production Rate Lowered 6,380 Bbl. From All-Time High

WASHINGTON. — The production rate of 5,192,100 bbl. daily of all petroleum liquids certified for June by Petroleum Administration for War is a drop of 6,380 bbl. from the May certification, an all-time high. Deputy Petroleum Administrator Ralph K. Davies emphasized that "production, even for a one-front war, must be maintained at the highest possible level to meet military and essential civilian requirements."

The June rate includes 4,859,600 bbl. of crude oil and 332,500 of natural gasoline and other petroleum liquids. The certification for crude oil is 6,900 bbl. less than the 4,866,500 certified for May. Natural gasoline and other petroleum liquids certification is 520 bbl. more than the 331,980 certified for May.

Total petroleum liquids production rate certified to the East Coast states was reduced to 63,000 bbl. daily. This resulted from a decrease of 3,000 bbl. in the crude-oil production rate and 200 in other petroleum-liquids rate. The decrease in crude-oil rate is in consideration of natural decline of productive capacity in the East Coast.

For the midwestern states the total petroleum liquids rate for June is 987,600 bbl., 6,100 less than the rate certified for May. This represents a net production of 5,500 bbl. daily in crude-oil rate and 600 in other petroleum-liquids rate.

Rates for individaul states in the Midwest remained unchanged except in Illinois and Kentucky, which were decreased 5,000 and 3,000 bbl. daily, respectively, and in Oklahoma which was increased 2,000.

PAW PRODUCTION RATES IN BARRELS PER DAY

	June 1945	
	Certified total petroleum liquids	Estimated natural gasoline and condensate
District 1—		
New York	12,000	.....
Pennsylvania	37,800	800
West Virginia	13,200	5,000
Total	63,000	5,800
District 2—		
Illinois	212,000	12,000
Indiana	13,000	.....
Kansas	278,100	4,100
Kentucky	30,200	2,200
Michigan	47,700	700
Nebraska	1,000	.....
Ohio	7,600	600
Oklahoma	398,000	28,000
Total	987,600	47,600
District 3—		
Alabama	400	.....
Arkansas	85,000	5,000
Louisiana	402,500	42,500
Mississippi	53,000	.....
New Mexico	110,000	5,000
Texas	2,333,000	163,000*
Total	2,983,900	215,500
District 4—		
Colorado	10,500	.....
Montana	23,300	300
Wyoming	116,600	3,100
Total	150,400	3,400
District 5—		
California	1,007,200	60,200†
Total U.S.	5,192,100	332,500

*Includes 16,000 bbl. per day separator condensate over and above anticipated plant production. †Includes 5,200 bbl. per day Paloma condensate production.

Oil and Gas to Have Important Roles In Du Pont's Huge Nylon-Salt Plant

BEAUMONT, Tex. — Natural gas and petroleum promise to have important roles in the $20,000,000 nylon-salt plant being constructed near Orange by E. I. du Pont de Nemours & Co., Inc.

Nylon salt is made from two complex chemicals, adipic acid and hexamethylene diamine. The job of the Texas plant will be to produce both of these compounds and then to combine them to form the salt, which will then be shipped to other plants to be converted into yarn, bristles, plastic articles, etc. Currently all the nylon salt is being made at the du Pont plant at Belle, W. Va.

Hydrogen is needed in the manufacture of both adipic acid and hexamethylene diamine; and natural gas, or methane, is a good source of this element. Methane consists of one atom of carbon and four atoms of hydrogen. The hydrogen will be separated from the carbon at the nylon plant by one or more methods. Natural gas also will be used as a fuel for some of the manufacturing processes.

In making the adipic acid, cyclohexane is used, which is at present made from a coal-tar product, benzene, by the simple addition of six atoms of hydrogen to the benzene molecule. This is one point at which the hydrogen from natural gas will be used in the Texas operations. However, cyclohexane is a naturally occurring component of petroleum, and it is hoped that eventually it will be possible to obtain it directly from this source. It constitutes from less than 1 to more than 4 per cent of the lighter distillate, the so-called naphtha fraction, depending on the source of the crude petroleum, but it must be separated out in relatively pure form for adipic acid manufacture.

Once the adipic acid is manufactured part of it is used in making the other half of the nylon salt combination, hexamethylene diamine. Here ammonia is required and more hydrogen from natural gas. The ammonia itself is made from nitrogen fixation process, and it will not be made at the Texas nylon plant. The hydrogen for ammonia synthesis may come from either natural gas or water, and the nitrogen from the air.

After the adipic acid and hexamethylene diamine are produced they are run together, in measured amounts, into a stainless steel kettle. A reaction takes place in which one end of the dibasic acid molecule hooks onto one end of the diamine molecule to form hexamethylene-diammonium - adipate. In simple terms, this is nylon salt. In dry form it is a white crystalline material that looks like ordinary table salt.

Davis Elected to Succeed Taylor as Shell Official

NEW YORK.—C. E. Davis, chairman of the catalytic cracking subcommittee of Shell Oil Co., Inc., and widely known in the field of refinery research, has been chosen vice president in charge of manufacturing to succeed J. F. M. Taylor, who has resigned.

C. E. DAVIS

Davis, a native of Oklahoma, obtained his early education in that state and in Missouri. He joined Shell in 1917 as a shipping clerk in the company's refinery at Cushing, Okla., and advanced through various positions in the company's refineries and manufacturing department until, in 1937, he was appointed assistant to the manufacturing vice president. Three years later he became general manager.

Taylor, whose resignation becomes effective June 15, will return to California, where he formerly served as president of Shell Development Co.

THIS WEEK

PRODUCTION—For fifth successive week national crude output hits new high, 4,868,050 bbl. daily, up 5,250. . . . Illinois, Kansas chief contributors, California off. . . . ¶Ickes says crude production to continue high till Japan is whipped. . . . Texas Railroad Commission cooperating, but concerned about maintenance of production higher than efficient rate. . . . ¶Bureau of Mines reports substantial progress in $1,500,000 oil-shale demonstration plant at Rifle, Colo. . . . To serve as proving ground for processes being developed. . . . ¶Total Venezuelan production first quarter 1945 is 36.2 per cent higher than in 1944. . . .

REFINING—OPA making cost study of over-all profits to determine ability of refiners to absorb any crude-price increase. . . . Rejects recommendation that survey cover refinery profits only. . . . Says earnings in all departments of integrated companies needed for ascertaining refinery profits. . . . ¶PAW says more than 14 per cent of aviation gasoline for Allies will be coming from foreign refineries by end of 1945. . . . Will be used intensifying raids on Japan. . . . ¶Notwithstanding reduced over-all gasoline yields resulting from types needed to meet war demands total output from record-smashing crude production to be only slightly less than 1944, PIWC survey indicates. . . .

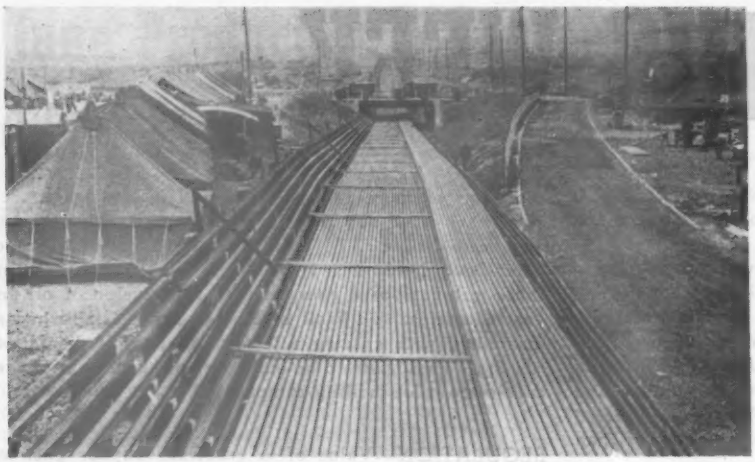
LEGISLATION—House passes reciprocal-trade bill extension, including provision for cutting impact duty on oil in half. . . . ¶Bill before Florida Legislature forbids inclusion of more than 10,000 acres in one lease. . . . Purchaser may not transfer leases until 6,000-ft. well has been drilled. . . . State owns millions of acres of submerged lands. . . . ¶Alabama passes law creating three-member board charged with supervision of oil and gas industries. . . . Well unit of 40 acres established as maximum, with spacing rules left to board's discretion. . . . State geologists to be enforcement agents. . . . Takes care of townlot drilling campaigns. . . .

REGULATION—Value of A gasoline coupons goes up June 22 from 4 gal. to 6. . . . PAW says that's best it can do in light of present and prospective military demand and current civilian inventories. . . . ¶Automobile industry receives official permission to manufacture 200,000 cars during remainder of 1945. . . . If it can get the needed materials. . . . ¶Motorists will have to get along with gasoline of current octane rating, PAW says. . . . War's demand for lead keeps it out of motor fuel. . . .

FOREIGN—Oil shipments from Kuwait, on Persian Gulf, to start early in 1946. . . . ¶American proposals for Anglo-American oil pact about ready for submission to British. . . . Department of Justice said to have acquiesced in antitrust exemption clause proposed by oil industry. . . . Other and minor differences smoothed out. . . . ¶Discovery of rich oil deposits at Arajuna, in Ecuadorean Oriente, reported. . . . Possibility of pipe line to Pacific discussed. . . .

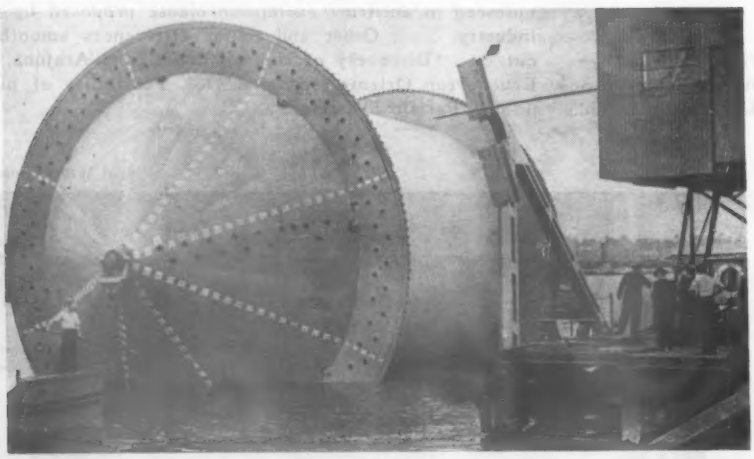
World Wide Photo

A pair of miniature scale-model pipe lines are proving valuable aids to technologists of Shell Oil Co., Inc.'s, transportation and supply department at East Chicago. Each of the model lines, one 6/10 in. in diameter and the other 2 in., is 1 mile long, coiling around the ceiling and roof supports in the photo. All conditions met in product-pipe-line operations are simulated and from the data compiled in the experiments technicians have perfected methods which can keep as many as 14 different products flowing in the same line simultaneously. This photo shows the start and finish point of a miniature line. In the background are the three tanks, each having 900 gal. capacity, which simulate the source of supply and the storage at point of delivery



Pipe stored in ¾-mile lengths ready for winding on the Conun-drums, huge seagoing bobbins which laid the pipe lines by rolling it off as they were towed across the channel. About 200 miles of pipe can be seen in this picture

"Operation Pluto" Fed Oil To Allied Armies in Europe



Drum being moved into position for loading the steel pipe. Fully loaded, they weigh 1,600 tons. The drums were moored in deep water at the end of the pipe racks so that the 4,000-ft. lengths might be welded into a continuous length and wound

FROM August 12, 1944, to May 8, 1945, about 120,000,000 gal. of gasoline reached the Anglo-American armies in Europe via the pipe-line system laid under the English Channel by British engineers in cooperation with the British Navy. One million gallons daily still reach France by way of 20 undersea pipe lines. Sixteen of these run from Dungeness, on the southeast coast of England, to Boulogne and four from the Isle of Wight to Cherbourg, and are thence carried via high-pressure gasoline lines to the Rhine. This vast engineering feat was called "Operation Pluto," meaning "Pipe Line Under the Ocean," and guaranteed uninterrupted delivery of bulk petroleum, usually needing a special harbor and dock and extensive storage facilities, across the beaches, making it invulnerable from air, surface or submarine attack, and completely independent of the weather.

While the British Pluto project was under way, the United States Army was working on a similar idea. After discussions between the respective authorities, it was agreed that efforts should be concentrated on Pluto, and United States authorities magnanimously cooperated fully in many directions. General Eisenhower and his chief officers took an active interest in Pluto's development, and a unit of the United States Army Engineers Corps, under the direction of Col. A. K. Easton, New York, arranged for the manufacture of 140 miles of HAIS cable by the General Cable Co., Phelps Dodge Copper Products Corp., the General Electric Co. and the Okonite Callender Cable Co. With the exception of the 140 miles of cable manufactured in the United States, the Channel pipe line was a purely British operation in plan and execution.

Experts Doubtful at First

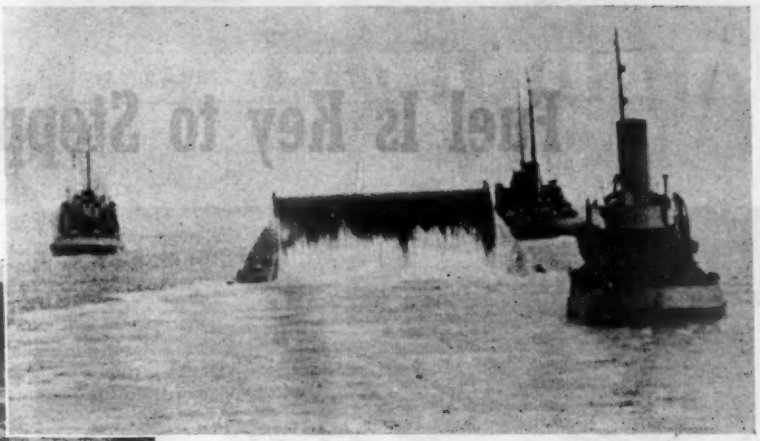
It was Lord Louis Mountbatten, then head of Combined Operations, who in April, 1942, asked Geoffrey Lloyd, British Minister of Petroleum Warfare, if an oil pipe line could be laid across the English Channel. The experts were doubtful, but A. C. Hartley, chief engineer of the Anglo-Iranian Oil Co., who had used 3-in. high-pressure pipe lines in Persia, suggested a pipe line something like a submarine electric power cable without cores and insulation, which could be laid across the Channel in a few hours from cable-laying ships.

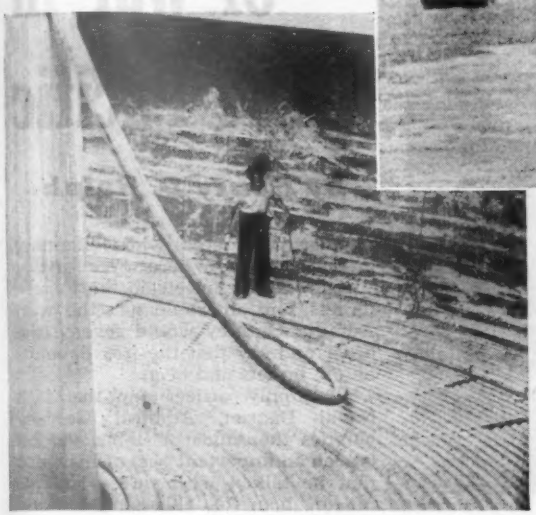
By working day and night over 2 week-ends, technicians of the firm of Siemens and Henleys completed the full-scale order for several hundred yards of this pipe line to be laid in the Thames from a cable-ship loaned by the British Post Office. The results were so successful that Prime Minister Churchill gave the scheme his blessing and two 30-mile lengths of cable were ordered to the original 2-in. diameter, so that full-scale trials could be held in Bristol Channel, where the currents and other conditions approximated most closely to those found in the English Channel. Subsequently, the cable diameters were increased to 3 in. and strengthened for working pressures in excess of 1,200 psi. Eight months after Hartley's idea originated, when half a gale was blowing in Bristol Channel, the experimental cable was laid and gasoline was delivered from Swansea to Ilfracombe. The fact that the cable was hollow increased the difficulties, since it was liable to kink and to stop the oil flow. The cables were therefore laid full of water, which kept them inflated. This pipe line was called the HAIS (Hartley-Anglo-Iranian-Siemens).

Meanwhile another pipe line was invented by B. J. Ellis, chief oilfields engineer of the Burma Oil Co., and H. A. Hammick, chief engineer of the Iraq Petroleum Co. This second

Below: The 3-in. Haid cable carried in the hold of the Liberty ship "Latimer" in one continuous length for the channel pipe line. The pipes are built for working pressure of over 1,200 psi.

Right: One of the drums being towed by the Royal Navy across the channel as it lays a continuous steel pipe 67 miles long. The drum is 40 ft. in diameter and 60 ft. long. (British Official Photographs)





pipe line, named "Hamel," was composed of 20-ft. lengths of 3-in. steel pipe which could be welded automatically into any length and could be wound onto a drum like thread on a spool, if the drum were 30 or more feet in diameter. To use this, the Admiralty's director of naval construction designed H.M.S. Persephone, converted from a hopper barge to a craft with a great wheel rotating in trunnions on her deck and capable of carrying many miles of the 3-in. Hamel pipe and paying it into the sea. From this a second idea was developed—a floating drum capable of carrying the full length of pipe which might be required for the channel crossing, and which could be towed by tugs like a large bobbin paying off the pipe as it went.

Within a few months, a special factory at Tilbury, in the Thames Estuary, was equipped for welding 20-ft. joints of the Hamel pipe into 4,000-ft. lengths at a rate of 10 miles daily, with facilities for storing the lengths to a total of 350 miles a day. Shortly afterwards a duplicate factory was established in case the first should be bombed.

The floating drums, called H.M.S. Conundrums (or "Conuns" for short) were moored in deep water at the end of the pipe-racks, so that the 4,000-ft. lengths might be welded into a continuous length of 30 or more miles, and wound onto the Conuns while they rotated. A Conun is 90 ft. long, over 50 ft. in diameter over all, and when fully wound weighs 1,600 tons—the weight of a destroyer. It can carry 70 miles of pipe line. The drum around which the pipe is wound is 40 ft. in diameter and 60 ft. long.

After the successful trials of the Hais cable in April, 1943, Geoffrey Lloyd arranged that the manufacture of Hais cable and Hamel pipe, and the coordination of the whole scheme, together with provision of pumping stations on the English shore, should be the responsibility of Britain's petroleum warfare department. The work then developed in conjunction with the Admiralty department of miscellaneous weapons development, while the Royal Navy accepted the responsibility of laying the pipe at sea. Thus Force Pluto was formed under Capt. J. F. Hutchings of the Royal Navy, composed of ships of all sizes from 10,000 tonners down to barges and motorboats manned by British merchant seamen. The force was placed under the command of Adm. Sir Bertram Ramsey, Allied naval commander.

Main Base at Southampton

Force Pluto's main base was Southampton, England, with a secondary base at Tilbury. The Force numbered 100 British merchant navy officers and 1,000 men. In addition to H.M.S. Holdfast, three merchantmen were fitted with the cable-laying machinery. Two could carry 100 miles and one, 30 miles of Hais cable. Thames barges were converted for handling the cable at the shore ends, where large ships could not operate. Six Conuns handled the Hamel pipe. New pipe lines were run from the British system to take the gasoline to the coast, and special high-pressure pumping stations were cleverly camouflaged. One of these was in a row of blitzed houses at Sandown, on the Isle of Wight; another was in an old fort built in the 1860's against possible invasion by Napoleon III; and others were in a modern amusement park and in seaside villas at Dungeness.

"Operation Pluto" began as soon as the mines had been swept to the approaches to the tip of Cherbourg Peninsula. The lines running from the Isle of Wight to Cherbourg took 10 hours to lay and conveyed gasoline to the United States armies. The lines established as soon as Boulogne was captured, from Dungeness to Boulogne, took 5 hours to lay and transported gasoline to the British 21st Army Group. Men of the Royal Army Service Corps pumped oil to cleverly concealed pumping stations on the French coast, frequently in rough weather, having to wade up to their necks to bring in the end of the line from the ships. An R.A.S.C. petroleum unit also maintains direct contact with the Trench terminals by cross-Channel wireless-telephone, thereby instantly detecting and reporting variations in the quantities delivered.

Auto Makers Authorized To Produce 200,000 Cars

WASHINGTON.—The automobile industry was given the official green light last week to make approximately 200,000 passenger cars during the remainder of this year if it can obtain the materials.

Present indications are that production of 400,000 cars may be authorized for the first quarter of 1946, assuming the availability of materials, and that authorized production may approximate 2,000,000 cars at the end of the auto industry's first postwar year of production.

Fuel Is Key to Stepped-Up Tempo Of War in The Pacific

When the fleet bases in a coral atoll in the middle of the Pacific the big problem is where to store the oil, not only for the fighting ships but for the service, supply, and repair ships which remain in the harbor, for transport planes which come and go, and for the assault forces for the next operations. "Floating tank farms" is the answer

by Henry D. Ralph

In this article, the third in a series by the Journal's Washington editor, the author describes how the war has moved clear across the Pacific due primarily to the oil supply methods which the Navy has perfected. Ralph's articles are from notes obtained at first-hand observation while visiting, as a war correspondent, Navy fueling and operating bases in the Pacific.

PEARL HARBOR.—It has become trite to say that the war in the Pacific depends on oil, but the full and continuing truth of that statement is plainly evident in a visit to the forward areas.

The Navy's oil men out here, most of them borrowed from industry for the duration, cite chapter and verse to prove that the success of military operations depends absolutely on their program for keeping the oil moving to the fleet and the shore stations.

Of course every outfit in the combined operations team — Marines, Seabees, fliers, submarine crews, and all the rest—boasts that it is responsible for our success. They are all correct, but oil is the life blood of them all and they received the oil, enough and on time, through the untiring efforts of a small and unsung group of petroleum officers who have worked wonders in logistics.

Take the word of Rear Adm. John J. Gaffney, an old-time Navy man now head of the Naval supply depot at Pearl Harbor and petroleum coordinator of all the services operating in this area.

Fuel is the key to the campaign, he says, and while the Navy has never been actually hampered by a shortage of oil, the fuel supply is the most critical thing any commander considered when planning an operation. Where Fleet Adm. Chester Nimitz once said that beans, bullets, and oil would win the war, Admiral Gaffney would reverse the order and say that the war depends on oil, bullets and beans.

As supply officer for the 14th Naval District, Admiral Gaffney handles thousands of items, yet oil is such an important part of his work that he talked with correspondents for an hour on this subject, and there was no doubt of his sincerity when he said that the availability of fuel is the determining factor in most tactical operations in the Pacific.

Even more specific was Capt. P. D. Lohman, area petroleum officer for the entire Pacific Ocean area.

In his opinion, the fact that the war has moved clear across the Pacific is due primarily to the oil-supply methods which the Navy has perfected, chiefly the so-called floating storage. This floating-storage concept, he explained, was very much of a gamble when it was first tried out, and many Navy men had their doubts about it. It was a big job, he said, but it has paid off, and

(Continued on page 60)

Tank-truck supply center in the Marianas. (Official U. S. Navy Photographs)

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Cartels

THE frank statements of the oil industry's representatives before the O'Mahoney committee should be helpful in arriving at a comprehensive and constructive postwar program as it affects cartels. There is probably no current political or economic subject on which there is more misinformation. It is unfortunate that the word "cartel" has come to be associated in the minds of many with international skulduggery and everything that is undesirable in business agreements.

Adoption of another word which more accurately reflects the present-day significance of business agreements in foreign operations would of itself aid in establishing the right attitude of Washington in the solution of problems involved.

The principles inherent in cartels as related to oil operations are simple. No operator or group of operators is seeking their application to domestic operations. The petroleum industry in this country was founded on open competition extending from exploratory activities to the retail sale of products. There has been no arbitrary division of markets among operators and none is wanted. Competitive practices extending over 85 years explain the cheapness, service and quality of petroleum products in this country.

It would seem that the records established in petroleum operations should prove an object lesson for other nations to follow. But such is not the case. Over most of the world, oil activities are directed or controlled by governments.

In distribution a common practice is to allocate outlets. In some cases this includes refining facilities. Governments set up the rules of participation, and private companies through agreements conform to them or look elsewhere for outlets.

This method also often extends to contracts between private companies in other countries. Research and development activities and all operations are furthered through trading or direct purchase of technical findings with restrictions as to where and how the information is to be used. Participation in these arrangements by American companies previous to the war brought to this country the "know how" rights which were vital in the production of 100-octane gasoline, synthetic rubber and other products.

There is nothing unusual or sinister in these activities. In peacetime it is the policy of our Government, in its diplomatic relations and its varied contacts with other nations, to take things as they are in the encouragement of international goodwill. Private business has no alternative but to pursue the same policy.

Thus the issues are clear. Our nationals must be free to go wherever petroleum is produced and consumed. If public policy is involved, our Government has the right to know the provisions of agreements applying to foreign operations. Obviously the same antitrust regulations effective in domestic affairs should not be applied in outside operating procedures which comply with the laws and customs of other nations.

At the same time private operators must be assured that in periods of national crises their peactime activities will not be misrepresented—as has been done in this war—for reasons of political expediency. Our continued dominance in world petroleum affairs, involving a healthy domestic economy and our future safety, is at stake.

Fuel Is Key to Stepped Up Tempo in the Pacific

(Continued from page 58)

the proof of it is that our ships and aircraft are operating in Japanese home waters today.

The size of the job, and the infinite difficulties of maintaining this floating storage in balance, are easily appreciated from a realization of the tremendous distances in the Pacific and the small size of the scattered islands along the path of our advance.

It is more than 5,000 nautical miles from the mainland to the Marianas where we were fighting last summer, an average of about 60 days tanker turnaround. And for 3,500 miles west of Honolulu there is not an island large enough to hold a fair-sized tank farm. Now the Marianas are considered almost back areas and our fleet is operating another 1,500 miles or so farther out, where there are no tank farms at all.

To add to the difficulties, the supply of ocean tankers is so limited that the movement of every one of them must be scheduled almost to the hour, and delay in unloading will throw plans askew for weeks to come.

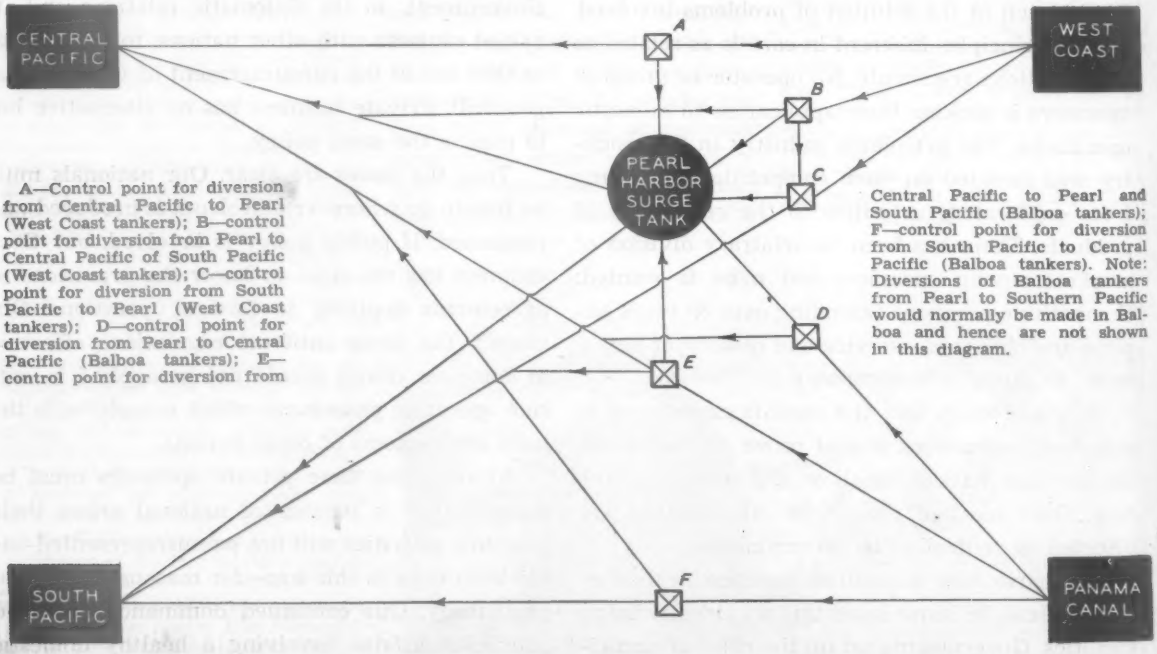
To meet this problem the Navy's oil men depend upon four types of storage.

First, there is fixed storage on the land-mass islands. The storage capacity at Pearl Harbor is tremendous, but it is never filled up nor allowed to get empty, for Pearl must act as a surge tank to meet emergencies and regulate the flow forward. There is moderate storage in the Marianas — Guam, Saipan, and Tinian—but chiefly to meet the needs of the many activities based there. Similar tank farms to meet "local requirements" presumably will be built soon in more forward areas, such as the Philippines and Okinawa.

CAPT. PHILIP D. LOHMAN COMDR. G. C. SHEPHERD LT. COL. W. J. WORCESTER

The second type of storage is the "floating tank farm." This consists of barges, concrete ships, converted Liberties, and oil tankers too small, too slow, or too barnacle encrusted for regular sea duty. These old vessels (IX's in Navy lingo) have seen all the coral atolls we have occupied from the Gilberts and Marshalls to the Western Carolines. But they can easily be moved forward, and before long these floating tank farms may be anchored in the Philippines, Okinawa, Shanghai, or Tokyo Bay. To them come the merchant tankers with oil from California or the Caribbean, and they in turn supply the "yard oilers" — small harbor tankers which supply nearby shore establishments and Navy ships coming into the harbor. There never seems to be enough of this floating storage, and constant juggling is required to maintain enough outage to unload incoming tankers and enough supply to meet scheduled and emergency requirements.

"Mobile tank farms" is what Captain Lohman calls the fleet oilers which constitute the third type of storage. These fleet oilers, commissioned ships of the Navy, are among the largest and fastest tankers in the world. Their job is to fuel the fleet at sea, a spectacular operation which is a "secret weapon" in itself. Without them the fleet could not roam



A—Control point for diversion from Central Pacific to Pearl (West Coast tankers); B—control point for diversion from Pearl to Central Pacific of South Pacific (West Coast tankers); C—control point for diversion from South Pacific to Pearl (West Coast tankers); D—control point for diversion from Pearl to Central Pacific (Balboa tankers); E—control point for diversion from Central Pacific to Pearl and South Pacific (Balboa tankers); F—control point for diversion from South Pacific to Central Pacific (Balboa tankers). Note: Diversions of Balboa tankers from Pearl to Southern Pacific would normally be made in Balboa and hence are not shown in this diagram.

Control of bulk petroleum products "tanker pipe line" flow to Pacific Ocean areas

far from its bases nor remain at sea for months on end. These fleet oilers run between the battle area and some sheltered anchorages in the Western Pacific where merchant tankers can refill them. As soon as more tankers can be put into the Pacific the transfer points probably will be moved much farther west and closer to the areas where the fleets are fighting.

The fourth storage facility in the Pacific are the merchant tankers themselves. This is an emergency and undesirable practice, but it has to be done on occasion in spite of the chronic shortage of tankers and the disruption of schedules when they are kept "swinging on the hook" waiting to unload. An example was when Adm. William F. ("Bull") Halsey made his famous spur-of-the-moment strike up and down the Indo-China coast he raised unholy Cain with Jap shipping, but he did the same with the oil-supply system, for the fleet oilers, of course, went with him. This was an unscheduled operation, and merchant tankers began to accumulate at the Western Carolines transfer point where all the floating storage in the atoll was full to capacity. The Army and Navy petroleum board clamored for release of the tankers, but Halsey's fleet was scheduled for a big strike immediately on his return and the area petroleum office back in Pearl Harbor had no choice but to turn the tankers into a tank farm for a while. It worked out all right in the long run, but it took a lot of figuring and maneuvering to get the tanker schedules and the flow of oil throughout the Pacific back to normal. It is such things as this, which for security reasons can't be explained at this time, that cause the exasperating fluctuations in tanker liftings at the ports.

Heart and Nerve Center

Heart and nerve center of this intricate operation is the area petroleum office of the Service Force, Pacific Fleet, at Pearl Harbor. Captain Lohman, the head of the APO, is a regular Navy officer with 22 years' service since he graduated from Annapolis. Among other achievements he was in charge of raising the old French liner Normandie after she burned at her dock in New York. He took part in the North African, Italian, and Leyte invasions before getting his present assignment.

Half of the APO staff of 16 officers are former oil men, and so are a number of the enlisted men who serve as yeomen and accountants. The others are regular Army and Navy officers or reservists drawn from other industries because of their knowledge of shipping, logistics, and military procedure.

Captain Lohman's right bower is Comdr. George C. Shepherd, Jr., executive officer and planning officer, and he is well equipped for the job. Since 1927 he had been with Union Oil Co. as research engineer, both economic and technical, and he has been a Naval Reserve Officer since 1928. He was one of the first reserve officers to be called to active duty after France fell in 1940. He arrived in Pearl Harbor last summer on another assignment but was immediately "drafted" for this job because of the Navy's need for trained oil men to handle its oil problems.

Commander Shepherd is a natural-born wizard with slide rule and chart, and can toss oil figures around like a juggler tosses plates. He is particularly proud of his statistical system—rows and rows of visual index cards which show how much storage for each product is available at every point in the Pacific, how much is in storage, what the anticipated needs are this week, how much is en route, where each tanker is at the moment, and so on. Different colored tabs are used for each product and each type of figure, and these colors dominate the room so that a visiting admiral described it as "the only Navy office operated in technicolor."

The left bower in the APO is Lt. Col. William J. Worcester, a West Pointer, expert in Air Forces petroleum logistics, and formerly assistant area petroleum officer in the Caribbean. His particular job is liaison with the Army Forces in the Pacific Ocean area, for the APO is responsible for all petroleum products used by all branches of the armed services between the mainland and Manila.

These three men are in constant conference, and their staff is kept on the jump, too, for they must control the movements of all tankers in the Pacific with clock-like precision.

The area petroleum office is one of the few organizations in the Navy which is both a planning and an operational outfit. Its estimates and requisitions for petroleum go directly to the Army and Navy Petroleum Board in Washington, and it is responsible to ANPB for operation of the tankers in the Pacific.

When loaded tankers clear the harbors of San Francisco, San Pedro, or Balboa they have a definite destination, but the chances are about even that they will be diverted somewhere along the line on orders from the APO. They might be told to unload into the Pearl Harbor storage in order to return quickly for another load, or because storage in the forward area is temporarily full. Or they might be sent to the Gilberts, the Marshalls, the Marianas, or some other point which has had a sudden drain of stocks. Similarly, a tanker returning empty might be pulled into Pearl Harbor to take on a load urgently needed up forward.

The most prominent thing on Commander Shepherd's desk is what he calls his "Prayer Book," bearing on the cover a large picture of a pair of hands folded in supplication. This is his weekly estimate of the bulk petroleum stock situation in the Pacific Ocean Areas, with a forecast of what the situation will be a month later. By means of his "technicolor" card-index system he can tell almost to the barrel how much of each product is in each area of the Pacific and how much will arrive during the ensuing 30 days.

The prayer part comes in estimating consumption in each of these areas; the problems involved in this job beat anything ever faced by an oil company marketing man.

Determining Needs

The APO, of course, is kept informed of all battle plans and activities which require the use of petroleum—and everything requires petroleum—but this isn't nearly enough to go on. Captain Lohman, Commander Shepherd, and Colonel Worcester have to smell out other factors which influence oil consumption. They take seriously all rumors of battles without waiting for official word, because it takes 30 days to get a tanker out from the coast and they have to be prepared.

For example, if the fleet finds good hunting and does a lot of fast battle steaming, its fuel-oil requirements will jump tremendously. A ship's fuel consumption increases roughly with the cube of its speed, so these APO men have to guess how fast the fleet is traveling in order to have just the right amount of fuel at the right place at the right time.

Incidentally, the APO once had to order the fleet slowed down when not in battle, and thereby saved a million barrels of fuel oil. The admirals grumbled a bit, but they played ball when it was demonstrated that without this saving there could not be sufficient fuel in the forward area in time for the next scheduled big operation. This is an example of how closely the APO has to figure, and of how petroleum logistics and battle plans must be dovetailed.

Weather is another factor which the APO has to watch like a hawk, particularly flying weather. If a carrier fleet's planes are kept out of the air for several days for some reason it means that forward stocks of aviation gasoline may pile up beyond the storage capacity. On the other hand, word that the B-29's have made an extra strike against Japan means that a lot more aviation fuel must be headed toward their bases. A single B-29 uses almost a tank-car load of 100 octane, 6,000 to 8,000 gallons, for a single

trip from the Marianas to Tokyo, and just the other day it was announced that 500 B-29's took part in a single raid and that one of the Marianas bases is now ready to handle 800 of these sky monsters.

In addition there are countless other unpredictable factors in keeping supplies in balance. The Pacific is covered with LST's (Landing Ship, Tanks), which are the work horses of the Navy, carrying all kinds of cargo in addition to tanks. Each LST has diesel bunkerage for 80 days, and it may or may not refuel at any port it touches, the decision usually being governed by factors beyond the control of the APO. This makes it very difficult to keep diesel stocks in balance anywhere, though a compensating factor is that the APO may have LST's unload part of their excess bunkerage at some port where diesel is badly needed for another purpose.

The radio silence imposed on ships in the forward area also complicates the estimates. The petroleum officers have to do a lot of guessing, and they are walking a tight rope all the time. In spite of these difficulties they boast that they have never kept a ship from sailing on schedule, though it often takes a lot of fancy juggling of stocks to maintain this record.

In spite of these difficulties, Commander Shepherd's multi-colored records have stood the test. The APO's long-range estimates have come pretty close to actual consumption and are even a bit on the conservative side, but the short-range guesses have often been wide of the mark for certain areas. In retrospect the officers laugh at the narrow squeaks they had when supplies temporarily fell far short of actual demands.

Just for fun Commander Shepherd plotted a curve of petroleum consumption in the Pacific since the war started and on the same chart he spotted the dates of all naval engagements and island assaults; the peaks of consumption coincided exactly with the degree of fighting—a graphic illustration of the fluctuating oil logistics of a naval war.

Incidentally, Commander Shepherd's slide rule and charts don't give him the whole story. One of the best requirements estimators he has is a yeoman who was a private detective in civilian life. Shepherd sent him out to "case" the various requisitioning units and question the officers, regardless of rank, about how they made up their estimates and how much oil they really think they are going to need, and he says this man's highly informal reports are a most valuable check on the official guesses.

It takes oil men to run an oil operation properly, and the Navy fully realizes this. Like the local fuel offices at every base, the Pacific Ocean Area petroleum office is well staffed with competent reserve officers drawn directly from the oil industry.

Oil Men to Help in Fixing German Reparations

WASHINGTON.—As members of the staff from this country which will serve in an advisory capacity at deliberations of the Reparations Commission, oil men will help in determining the part Germany must accept in rehabilitation and restoration of overrun territory.

"The men chosen for this vital mission should inspire the confidence of all Americans," says a statement from President Truman. "They are eminently qualified to do the job."

The selections were made by Edwin W. Pauley, United States member of the commission, and his associate, Isador Lubin. Pauley is president of Petrol Corp. of Los Angeles. He will be President Truman's personal representative in reparations discussions.

The staff chosen to accompany Pauley and Lubin includes J. Howard Marshall, president of Ashland Refining Co., Ashland, Ky., and formerly assistant deputy administrator of Petroleum Administration for War, and Jubal R. Parten, Houston, former director of transportation in PAW, and president of Woodley Petroleum Co.

Appropriation for Oil Subsidy Is Passed

WASHINGTON. — A $290,000,000 appropriation for petroleum and petroleum-products subsidies for the 1946 fiscal year was passed this week by the House of Representatives. The bill, S. 502, covering a wide variety of subsidy payments, had previously been passed unanimously by the Senate.

The petroleum appropriation covers payments for four subsidy programs. These include:

1. Compensation for extra costs in transportation of petroleum from PAW Districts 2 and 3 into District 1.

2. Compensation to refiners for transportation costs in shipping from District 3 and parts of District 4 into District 2.

3. The stripper-well compensatory adjustments program.

4. Movement of crude from West Texas to California.

Of the total, $75,000,000 covers the stripper-well program, and $215,000,000 the three transportation-subsidy programs.

Share Your Journal With a Service Man

This issue of The Oil and Gas Journal can be mailed to any service man in the United States for 5 cents.

Due to weight restrictions, it cannot be remailed to an APO or Fleet address unless requested by a service man.

DEATHS

Frank S. Preston, 83, pioneer oil operator, died May 20 in Brownwood, Tex.

Earl Wilson, 66, regarded as among the country's most expert oil-well drillers, died in Tulsa May 24 of injuries suffered a short time before when he fell from rafters of his garage. He was employed as a driller in Romania by a subsidiary of Standard Oil Co. (New Jersey) from 1910 to 1916. Returning to the United States, he was employed by The Carter Oil Co. until his retirement in 1933.

Ambroise Delcambre, 62, independent oil operator of Texas and Louisiana, died May 23 in Dallas. The town of Delcambre in Louisiana was named for his family.

John L. Henning, 66, of Sulphur Mines, La., active in development of the Southwest Louisiana oil industry, died May 21. Henning formerly was president and manager of Union Sulphur Co.

J. E. Fogel, 84, formerly a drilling contractor and oil producer with his father and later conducting the business with his son, Carl S. Fogle, died May 22 at Kinzua, Pa.

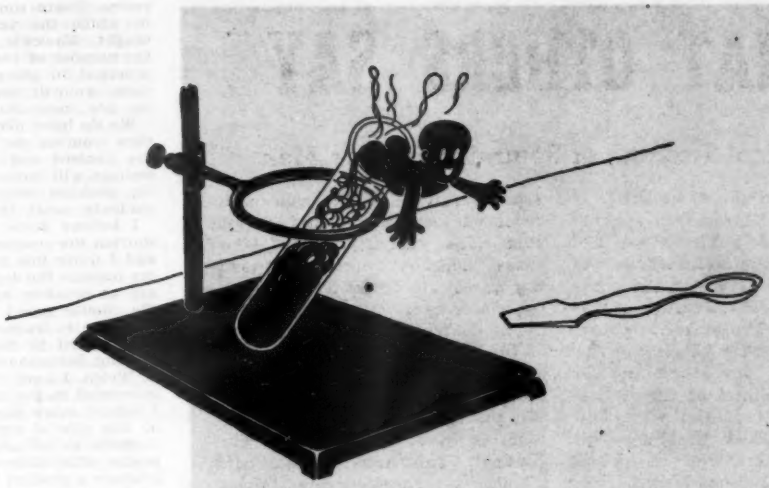
Staff Sgt. Ellis E. Pringle, 29, in the employ of Richfield Oil Corp., Los Angeles, when he entered military service, was killed in a bomber crash in New Mexico. He was an aerial photographer.

Thomas T. Morgan, 88, oil producer of Emlenton, Pa., died May 16.

Herschel M. Payne, 63, independent operator, died May 17 in Texarkana, Tex.

William I. Sims, 58, independent oil operator and formerly a practicing attorney, died May 26 in Dallas.

Amos F. Ledebur, 78, oil producer, died May 25 in Tionesta, Pa.
sion in its study of the natural-gas industry."



Test Tube Baby #1
Thermal Cracking

Since the birth of this baby many years ago, gasoline has been made from all types of oil by heat and pressure methods. Thermal cracking will continue to be a basic refining process for many more years.

This baby has grown into a giant that has produced more than 4.5 billion barrels of gasoline thereby conserving the equivalent of over 21 billion barrels of crude oil in the U. S. A.

The UOP thermal cracking process is extensively used and continues to be the leader in the field—new units are constantly being installed.

He is the big brother of the many UOP processes.

CATALYTIC CRACKING
CATALYTIC REFORMING
HYDROGENATION
ALKYLATION
ISOMERIZATION

THERMAL CRACKING
THERMAL REFORMING
HYDROFORMING
DEHYDROGENATION
POLYMERIZATION

RETREATING
POLYTREATING
U. O. P. CATALYSTS
UNISOL TREATING
U. O. P. INHIBITORS

Universal Oil Products Co.
Chicago 4, Ill., U. S. A.

UOP

Petroleum Process Pioneers
For All Refiners

The Refiners Institute of Petroleum Technology

Copyright 1945, Universal Oil Products Co.

Terminal Curricula Instituted

University of Minnesota

Sirs:

You raise a very important question. Many of the returning veterans will undoubtedly wish to shorten the time necessary to prepare for some occupation. To help in meeting this need we have instituted a series of 2-year terminal curricula for the training of technical aids for subprofessional positions. As yet we have not included anything especially designed for the petroleum industry, but we can easily extend our offerings in that direction whenever there should appear to be a local need for it. We have designed these curricula to prepare men to enter our own local industries, but I am confident that many institutions will be in a position to offer training of this kind in the field of petroleum technology.

S. C. LIND,
Dean, Institute of Technology.

Special "Refresher" Courses

Pennsylvania State College

Sirs:

The large percentage of technically trained returning veterans, regardless of their specialty, will have forgotten what they have learned in college, and what is worse they will have also lost the use of their reasoning ability in scientific matters. However, it is believed that this can be remedied very quickly if the veteran will take time to enroll in a refresher course which need not necessarily be longer than 1 semester. We would recommend that he stay 2 semesters, and earn an M.S. degree, if possible.

A further disadvantage which the veteran will face is the changed technology which has taken place in the last few years while he was in the service. This is particularly true in the production branch of the oil business, for instance, where petroleum technology has definitely taken a turn toward a better understanding of reservoir performance or "reservoir engineering." This term will sound quite unfamiliar to the returning veteran who was snatched into the armed services a few years back right after or even before graduating from a course in petroleum engineering.

As far as this particular situation is concerned, it is believed that it could be alleviated by the veteran's attendance at a special intensive course on the subject at a school prepared to give such a course. It might be suggested that an oil company hiring a returned veteran should send him at company expense to register and take such a course. We are prepared to give such an intensive course in reservoir engineering whenever there is enough demand for it.

EDWARD STIEDLE,
Dean, School of Mineral Industries.

Separate Sections for Veterans

A. & M. College of Texas

Sirs:

A. & M. College has plans for the return of veterans and at the present time there are some 90 returned veterans enrolled here. These veterans are not subject to any of the military routine which ordinary students are required to take. The college has done everything possible in this respect and still keep A. & M. predominantly a military college.

I question the advisability of keeping veterans separated from ordinary civilian students which we are now doing, although I readily see that very few veterans would want to be subjected to any form of military formality which they would come in contact with when living in the dormitory with regular underclassmen. I further believe that these returning veterans should come in very close contact with civilians and I know that they should have contact with girl students as certainly they have missed this phase of life more than anything else while in the service.

I do not believe that we can handle satisfactorily returning veterans and the teen-age college students in the same class rooms. There should be separate sections in which the veterans alone should be taught. However, it is realized that until the number of veterans returning make it practical to place them in separate sections, we will have to get along the way we are now doing.

We do have plans for refresher and review courses for returned veterans but the content and time required for such courses will have to be determined when the problem arises in order to give the students what they really need.

I believe there will be an attempt to shorten the courses for returning veterans and I think this is poor policy because in my opinion the 4-year engineering courses are as obsolete as the horse and buggy. We should spend more time rather than less time in training our engineers.

In regard to the article entitled Engineering Salesmanship and Training by L. C. Welch, I have found very few students interested in the sales end of engineering. I believe more emphasis should be placed on this side of engineering. We train our students to be production minded, but it makes little difference how cheaply you produce a product if it cannot be sold at a profit. It is the salesman who keeps the plant producing and our men working, by selling the products the men produce. I have mentioned these things many times in class but have received very little response from my students.

HAROLD VANCE,
Head of Department of Petroleum Engineering.

Oil Companies Could Help

University of Texas

Sirs:

Undoubtedly there will be a big gap in the number of engineers available for industry after the war due to the fact that so few were trained for the industry during the emergency years. Undoubtedly many young men who would have pursued engineering careers have assumed the responsibility of families which will make it harder to come back to school after the war. Of course, the veterans will be assured some compensation and some will find it more to their advantage to resume their education than to go into the industry without the technical training.

I agree with you that oil companies could help the situation by assuring employment upon completion of the college course. We do expect that many who have started their engineering courses will come back and finish. There has also been a demand for graduate work on the part of those who have been away and would like to brush up on their work. Then there is the matter of refresher courses for those who would like to learn something of current problems and technology.

It looks to us as though it will require at least 5 years after the war for the schools to catch up with the requirements of industry. From the standpoint of world-wide operations, which brings into focus the acute need for men of engineering training, the picture is one of expansion, and some of the companies feel that they will be understaffed considerably after the war ends.

H. H. POWERS,
Chairman, Department of Petroleum Engineering.

"Horizontal" Divisions Required

Illinois Institute of Technology

Sirs:

It is our belief that the vertical division into curricula of civil, electrical, mechanical, and chemical engineering, etc., has served a useful purpose but that broad horizontal divisions are also required. We

have in mind, therefore, separation of those students especially interested in research and development work from those whose interest is in the more practical phases of engineering. A third horizontal division will be arranged for those students having special interests and competencies in the general field of management. On the basis of these three options, I believe that the educational opportunities of the students will be greatly improved and that we will successfully center their attention more pointedly in their studies.

Evidently, the expenses involved in handling education on this basis will be greater than the normal costs of engineering training. Much could be done by the petroleum industry to subsidize the option in research and development through establishment of research laboratories of petroleum technology in educational institutions. I believe that this would be a direct contribution of the petroleum industry to its own ultimate advancement.

L. E. GRINTER,
Vice President.

Question What to Eliminate

University of Michigan

Sirs:

Regarding the editorial, I think your position is very well taken. While the policy of the University of Michigan is formulated in general lines to aid and hasten the completion of interrupted university studies in all possible ways, the actual procedures have not yet been completely worked out.

At the present time the university is still operating on the accelerated program which permits the completion of three full terms per calendar year or the completion of a normal 4-year course of eight terms in 2 years and 8 months. While our experience with this accelerated program on the part of young men directly from high school indicates that the older usual procedure of two terms with a summer vacation is probably better for the normal student, it is very possible that this accelerated program may be of assistance to the returning veteran who is anxious to complete his academic training as well as possible. For this reason it may develop that we shall continue the accelerated program, or some modification of it for the express purpose of hastening the completion of the training of these men.

The suggestion made in your editorial of assuring employment upon completion of the college course, or the granting of leave from actual employment by a company, should encourage many men to complete their technical training.

Similarly the establishment of fellowships for superior students for graduate study, and corresponding scholarships to assist those in the undergraduate curriculum, would not only increase the supply of men of superior ability of technical training but also tend to make these men more promptly available by encouraging the qualified veterans to complete their technical training.

There is also a disposition on the part of most schools to allow credit to the returning veteran for special courses which he may have taken by correspondence as through the USAFI or for special training courses he may have taken in the Army or Navy wherever a proper evaluation of this work is possible. Plans are also being considered for the inauguration of what may be called refresher courses, in which the work the student took before he entered the service may be quickly reviewed so that he may proceed more satisfactorily with the new work. As these plans go into effect, and I believe they will if there is sufficient demand on the part of the returning veterans for this service, the veteran may find that he can complete his college training in a relatively short time and will be disposed to do so if he receives encouragement from industry.

Referring to the article by Mr. Welch, I should like to state that I am in thorough agreement with his statements and philosophy. There is considerable pressure on the part of the engineering colleges from many sources to include subjects such as history, labor conditions and problems, in addition to the present requirements in English, public speaking, and economics which are now rather general. We all recognize the desirability of giving the student training in these fields. One of the main functions of an educator is to select the material and to offer it with proper emphasis to the student.

Without attempting to explain the reasons for this condition, but simply recognizing that it places an additional and frequently an impossible burden on the college or university which has a student for not more than 4 years, the question becomes what should be eliminated from the present college curriculum in order to cover these other fields, and is it not perhaps better to cover the technical subjects in college which the student will use promptly upon his entering industry with the hope that he will continue by self study and actual practice to acquire an appreciation of history, contracts, labor conditions and problems as well as money, currency, and banking as he runs into such labor problems and perhaps acquires more money to handle? Is this condition not particularly applicable to the employes of a large company which carries a program of education and training such as outlined on pages 96 and 97 of the February 17, 1945, issue of The Oil and Gas Journal. We must keep in mind that we are training engineers for all types of engineering work, design, construction, operations, research as well as sales and management.

GEORGE GRANGER BROWN,
Chairman, Department of Chemical and Metallurgical Engineering.

A Dangerous Situation

Pennsylvania State College

Sirs:

Heartiest congratulations on your editorial on technical manpower in relation to the petroleum industry on page 38 of the April 14 issue. This situation is likely to be even more serious than you have pictured it. Keep up hammering. It is high time that some of our representatives and senators were warned of this dangerous situation.

In the annual report of the Rockefeller Foundation for 1944 the American shortsighted policy on the training of technologists has been criticized in no uncertain terms.

F. C. WHITMORE,
Dean, School of Chemistry and Physics

Companies Seek 1942 Grads

University of Missouri

Sirs:

It will be about 5 years, possibly 6, before Missouri School of Mines can get back to a normal graduating class such as we had in 1942 when we graduated 212 boys. Last year we graduated about 100 and this year we will graduate about 30, approximately 15 per cent of a normal graduating class. The number of graduates next year is most uncertain.

Until April 1944, deferment policy permitted draft boards to allow students to remain in school if they could graduate in 2 calendar years. Most of these did remain in school and graduate with the exception of some few who had enlisted in the Enlisted Reserve Corps and were called to active duty before they had time to finish. A large percentage of the boys who come back after the war will be just starting or will have finished less than 1 year of work. At first we expect to have abnormally large freshman and sophomore classes which will, in 5 or 6 years, work into normal graduating classes.

Many of the larger companies realize this fact and have come to us for lists of graduates, particularly of the class of 1942 and later, who went immediately into military service and who had no contact with industry and hence no jobs to which they can return at the close of the war. These boys are being contacted by personnel representatives who are looking forward to employing them after their discharge from military service inasmuch as they are the next available group of young engineers to which industry will have access.

CURTIS L. WILSON,
Dean, School of Mines and Metallurgy.

Personal Attention to Veterans

University of Kansas

Sirs:

I read the original articles by Mr. Welch, and have been greatly interested in the training courses mentioned.

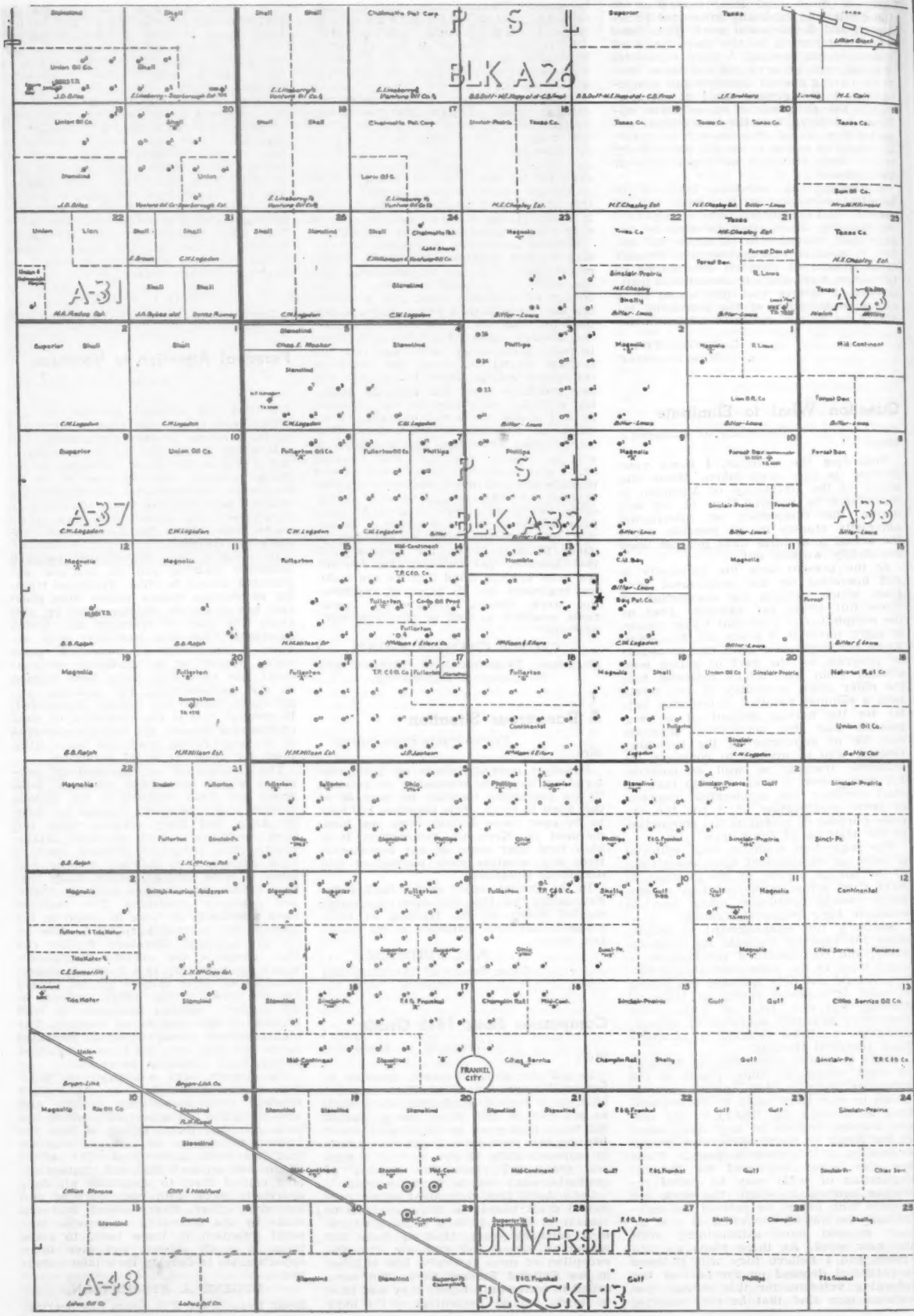
It seems to me that this type of training course is somewhat analogous to the trainee courses given by most of the oil companies to graduates of engineering schools. Such training tends admirably to supplement the broad theoretical principles which form the basis for all engineering curricula.

In general, the delineation between academic training and its practical application should be clear. Technical training emphasizes theory rather than practice, but should be supplemented by precisely the sort of training Mr. Welch describes. Very few engineers ever acquire a knowledge of theoretical principles outside of an academic environment, but once they have been trained in the fundamentals, the practical applications thereof are rapidly assimilated. In general, this is the viewpoint of most engineering schools, and the achievements of the engineering graduates leave little room for doubt as to its soundness.

The "intensified" or "speeded-up" programs which have been given to both Army and Navy students in the various colleges under programs outlines for them by Army and Navy officers, have not been conducive to high scholastic attainments. The programs involve such a rigid adherence to military routine and allow so little time for actual study that they cannot be compared with the standard academic programs. The students have practically no time to spend in the library, they cannot keep up to date on current technical literature, neither can they complete the outside assignments which are necessary to a thorough understanding of their subject matter. These are the views of the better students in the military training programs, as well as those of the experienced teachers. The high scholastic standards which prevailed before the war have not been maintained during these speed-up programs.

We already have a number of "G.I." men in the University who are serious minded, show exceptional ability, and who recognize the opportunity which has been afforded them, either to take refresher courses, or to continue training that has been interrupted. The effect of the war on such men has unquestionably caused them to undertake all their university work with high purpose and intensive effort. Every effort is being made by the university to provide personal attention to these men, to place them in small classes, and give them opportunities to develop their latent abilities.

EUGENE A. STEPHENSON,
Head, Department Petroleum Engineering.


BLK A26
BLK A32
A-31
A-23
A-37
A-33
A-48
FRANKEL CITY
UNIVERSITY BLOCK-13

Fullerton Pool Is Guidepost in Developing Clear Fork and Devonian Reserves

by Kenneth B. Barnes

THE big Fullerton pool in Andrews County, West Texas, is serving as an excellent guidepost for much of the busy deeper development that is widespread over the Central Basin Platform area. While the Ellenburger is the ultimate objective of many wildcats in the large territory encompassed, the substantial reserves already proven in the Clear Fork (Lower Permian) and Devonian now entitle these formations to prominent rank among West Texas pays.

The Clear Fork and Devonian are two formations now the objectives of much exploratory work in West Texas and New Mexico. A great amount of acreage in several new pools has been proven for these horizons, and more heavy rigs are engaged in the play than in any other single activity in the country. This article discusses drilling production, completion and reservoir details for Fullerton, now a 300-million-barrel reserve and where both formations were first found productive in the area.

Fullerton, definitely a pool of major proportion, might be termed the center of the Clear Fork and Devonian activity since both first gained prominence there as important sources of West Texas oil. The Clear Fork discovery was Fullerton Oil Co. 1 Wilson, completed in February 1942, and the Devonian was opened by Mid-Continent Petroleum Corp. in August 1944.

To the north, Clear Fork production is found in the Lubbock pool, Lubbock County; the Smyer pool, Hockley County; in the Russell, Eubank, and Wasson pools of Gaines County; to the south in some wells in Ector, Winkler, Ward, Crane, and Pecos counties. Westward a few miles from Fullerton and into the eastern edge of Lea County, New Mexico, is the Clear Fork production and exploratory drilling in the Drinkard area. Something like 9 to 10 million acres are embraced in this total expanse, and it is likely that continued exploration and development of the two new pays will result in the addition of a billion barrels of crude to the reserve list.

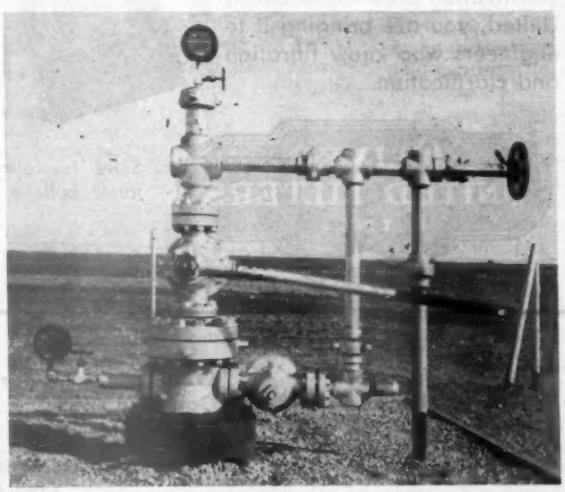
Also in Andrews County is the Union pool (Wichita-Albany) which adjoins Fullerton to the northwest, and the Embar field (Clear Fork) on the south county line. Recently, also in Andrews County, Sun Oil Co. 1 N. H. Martin in Section 17, Block A-41, PSL Survey, had top of Clear Fork pay at 6,790 ft. (elevation 3,314 ft.), perforated at 6,850-7,036 ft. and flowed 301 bbl. per day through ¼-in. choke.

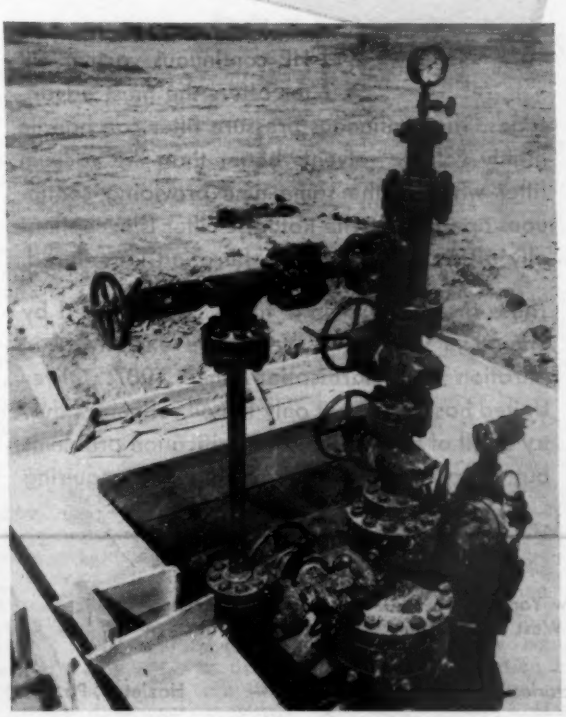
The Devonian production in the

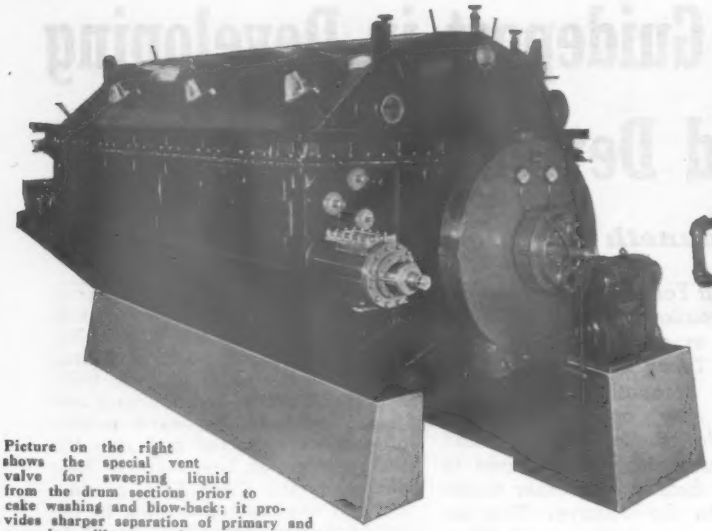
Fig. 1—(Opposite page) Map of Fullerton pool, Andrews County, West Texas. Representing by far the largest development of production from the Clear Fork ("Wichita") formation of the lower Permian, three pay zones are present. They reach maximum total thickness of 250 ft. between 6,800-7,300 ft. In the south area, three wells (double circled) in Sections 20 and 29, University Block 13, have been completed in the Devonian at 8,500-8,600 ft., and a well just finished in the same formation 3 miles farther south adds considerable extension or opens a new pool. The Union pool (Wichita-Albany) is shown in the northwest corner. (Map courtesy The Western Co., Acidizing Service, Seagraves, Tex.)

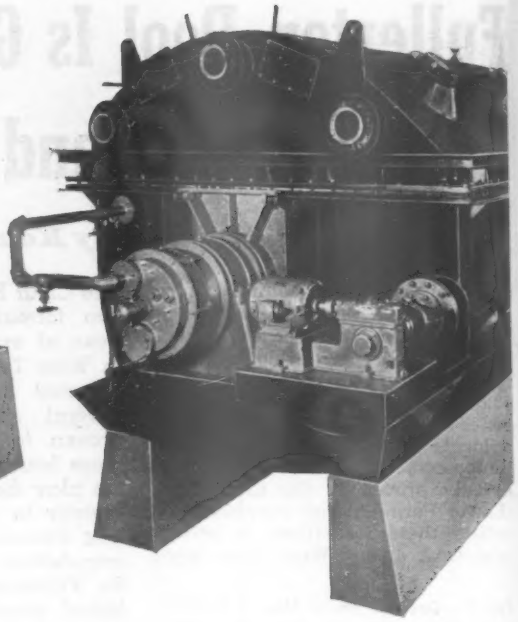
Fig. 2—(Below) Typical Clear Fork producer at Fullerton. These wells, for drilling, casing, tubing, completion, cost approximately $100,000, have allowable of 118 bbl. per day

Fig. 3—(Right) Devonian production in West Texas was opened up in a big way by this well, Mid-Continent Petroleum Corp.'s 1-7 University, Section 20, University Block 13, depth 8,470 ft.









Picture on the right shows the special vent valve for sweeping liquid from the drum sections prior to cake washing and blow-back; it provides sharper separation of primary and secondary filtrate and prevents backflow of filtrate.

1. Oliver Continuous Vacuum Filter

2. Oliver Continuous Pressure Filter

3. Oliver Rotodisc Batch Pressure Filter

THE continuous vacuum filter offers the most advantages. The continuous pressure filter can handle highly volatile solvents better than the vacuum filter while at the same time providing continuous operations. The Rotodisc Filter is exceptionally efficient where batch filtration is required.

These three "dewaxing" filters are designed by engineers who have specialized exclusively in filtration and clarification since 1907. Oliver United has served not only the oil refinery industry in all of its filtration or clarification problems but every other processing industry requiring filters. Nearly 17,000 Oliver United Filters have been installed in these industries throughout the world.

So, when you bring your dewaxing or other filtration or clarification problem to Oliver United, you are bringing it to engineers who *know* filtration and clarification.

Send for our latest bulletin.

OLIVER UNITED FILTERS INC.

New York 18, N. Y.
33 West 42nd Street

San Francisco 11
California

Chicago 1, Ill.
221 N. LaSalle Street

Western Sales Division
Oakland 1, Calif.
2900 Glascock Street

Factories: Oakland, Calif. — Hazleton, Pa. — Orillia, Canada — Melbourne, Australia

6-OUF-6

Fig. 4—Cores and saturation samples of the Clear Fork at Fullerton, ready to go to the laboratory. In this pool the cooperative engineering association laid out a "pattern" for field-wide coring which has aided greatly in building up a complete reservoir picture

south end of Fullerton has been followed by discoveries in that formation in the TXL pool of Ector County, and lately, in between, by Stanolind Oil & Gas Co. 1-D University in Section 8, Block 11, University Lands, southwestern Andrews County. Here the Devonian was topped at 7,968 ft. (elevation 3,377 ft.), the section 8,300-50 ft., acidized, and a flowing gage of 575 bbl. per day obtained.

In number of producing wells and proven reserves in the Clear Fork, the Fullerton pool, however, overshadows others currently producing from this formation. Fullerton has approximately 200 wells completed in the Clear Fork. There are 17 in the Union pool. In the south end of Fullerton, three Devonian producers are in. Stanolind 1-P University producer in Section 44 either extends the Devonian area of Fullerton 3 miles south, or opens a new pool. About 60 rigs are running at Fullerton and 4 are active at Union. Estimates of Fullerton reserves run as high as 250 to 300 million barrels. The map (Fig. 1) shows the Fullerton and Union pools.

Drilling Clear Fork Wells at Fullerton

Drilling and completion cost of the 7,300-ft. Clear Fork wells, ready for production, is approximately $100,000.

The Clear Fork pays are found between 6,800 and 7,300 ft. Ordinarily it takes 40 to 50 days to land and cement the oil string, preparatory to coring or drilling in, acidizing and testing. Surface casing, usually 10¾ or 13-in. o.d., is set at 200 to 300 ft. and cemented with 50 to 250 sacks. The Salado salt formation occurs from about 2,100 to 3,300 ft. or deeper. An intermediate, or salt string, 7⅝ or 8⅝-in. o.d., is often set at about 3,800 ft. and cemented with 250 to 1,700 sacks. Many of the oil strings are 5½-in. o.d. and are cemented with 350 to 500 sacks, on top of or through the pay zones.

The salt section usually is drilled with a saturated salt solution or a starch-type mud. From the seat of the intermediate string to the top of the Clear Fork, drilling is done with water to which sometimes caustic soda is added to raise the pH to 7.5 or 8.5 to protect the drill pipe from corrosion.

Earlier practice was to drill or core the Clear Fork pay zones with crude oil for circulating fluid. Fullerton crude oil, however, is of 41°-43° gravity, and the procedure was dangerous with respect to the fire hazards presented. Drilling or coring practice now often employs a starch-type mud which is held to a filtrate loss of 5 cc. or less, with the pH at about 12. In drilling the Devonian wells to the south, practice is to use a low filtrate loss mud below about 6,500 ft.

Fastest drilling time in the field has been at Superior Oil Co. A-2 University in Section 8, Block 13, University Land. Here 33 drilling days elapsed to the setting of the 7-in. o.d. oil string at 6,789 ft. Three 350-hp. engines, at 7¾-in. by 20-in. pump, a 32-ft. by 154-ft. derrick, and 4½-in. drill pipe were used. A second 7¾-in. by 20-in. pump, driven by two 350-hp. engines, was available for standby.

On this well 12 rock bits were used in drilling the 19¼-in. surface hole to 300 ft. and the 12¼-in. hole to 3,834 ft. In continuing the 8¾-in. hole to 6,800 ft., 19 bits were used. The 13⅜-in. surface pipe was cemented with 400 sacks, the 9⅝-in. intermediate string with 500 sacks and the 7-in. 23-lb. extreme-line oil string with 600 sacks.

Another Superior rig, on D-3 University, is following with practically the same performance, using 4-in. drill pipe.

All of the wells at Fullerton are flowing naturally except one on the east side in Section 11, Block 13, University, one each on the southeast and southwest sides, and the one (5 bbl. per day) 2,850-ft. Yates sand oil well that is located in Section 11, Block A-37, PSL Survey.

In Fig. 2 is shown the surface hookup on one of the Clear Fork wells at Fullerton, while Fig. 3 pictures the christmas tree on a Devonian producer.

Fullerton Pool Engineering Committee

In common with several large West Texas fields, numerous geological, production, reservoir, and engineering data for the Fullerton pool are assembled and recorded under the auspices of an engineering association, the membership composed of engineer representatives for the different operators.

Work of the Fullerton Pool Engineering Committee commenced in 1943. An office is maintained in Midland, where a stenographer-clerk assembles the information sent in by the companies and issues monthly reports. The engineering representatives meet monthly for discussion and work on the different phases and functions involved.

Study of Pressure Maintenance Being Made

Currently the engineering association is well along in investigations of reservoir factors and conditions necessary for a study of feasibility of pressure-maintenance or gas-return operation. Farsightedly for this objective, early in the development of the pool, a plan was set up for coring selected locations. These were strategically spaced throughout the prospective area, with many of the operators participating, so that a comprehensive picture of the reservoir could be obtained. Such a cooperative plan, made early in the development, and revised if necessary at later intervals, should be good business as an integral part of the drilling of any new pool. View of series of Clear Fork pay cores, with "canned" saturation samples, ready to take to the laboratory for testing, is shown in Fig. 4.

Gasoline Plant Now in Operation

Phillips Petroleum Co. and Fullerton Oil Co. have recently constructed and placed in operation a natural-gasoline plant. The plant is presently processing about 12,500

M.c.f. per day. The plant gathering systems are designed to handle larger volumes in the future and the plant proper is laid out in such a manner that additional units can be added as needed. The plant operators have completed plans to double the capacity of the compressor facilities this year.

The gasoline plant is located in the center of the pool. The location of the plant and the facilities it represents would make the additional investment for a pressure maintenance by gas-injection project cost very much less in the way of additiona investment on the part of the oil operators than if all the facilities had to be installed and charged to pressure maintenance.

Certainly the increased ultimate recovery involved in pressure maintenance at Fullerton may be sizable on the basis of various comparisons[2,3], perhaps of the magnitude of 60 million barrels of additional oil. The uniform 40-acre well spacing would be helpful in such operation, and the coring plan, core analyses, geological, and electrical - log data are serving in good order for detailed pay-section evaluation for bases necessary in operations as well as unitization.

Three Clear Fork Pay Zones

Structurally, Fullerton is a broad high running north and south, with steeper dip on the east, and about 400 ft. relief on the Clear Fork from the highest to the edge wells. There are numerous localized highs on the major feature, some on different lines of strike. Moore[4] recently has given details of the geology involved.

Three Clear Fork pay zones are present in a good part of Fullerton. In the central portion, maximum total thickness of the upper zone, counting footage of very low permeability, is about 70 ft. There is a dense lime break of 10 to 50 ft. to the second pay zone, which attains maximum thickness of about 200 ft. on the same basis.

There is a similar break between the second and third zones. The third zone has an average thickness of 150 ft.

In a few edge wells, small amounts of sulfur water have been found in the first Clear Fork zone, and salt water in the second. Salt water underlies (bottom water) the third zone, with the contact at about —3,900 ft.

Majority of the Clear Fork porosity is found in crystalline dolomite, although some places there are sucrose and cavernous porosity. Most of the porosity in the first and third zones is 8 to 10 per cent. Much of the permeability is less than 1 millidarcy and the better values are in the range of 1 to 10 millidarcys. The second zone is the best developed pay with porosity about 15 per cent, and better permeability (still, generally, less than 50 millidarcys).

Wells in the Union pool, in Sections 11, 12, 19, 20, Block A-31, PSL Survey, produce from the "Union" pay of the Wichita-Albany. Sulfur water is found in that zone, off structure, and the dissolved gas carries 4,000 grains of H_2S per 100 cu. ft. However, to the north in Section 9, Union Oil Co. 6 Biles had been completed in the Fullerton Clear Fork for a 50-bbl. pumper, and to the south, in Section 22, Union 1 Redus is a Clear Fork well.

Area and Reserves

The distance from the Clear Fork production from the 6 Biles to 1-P University well (where some Clear Fork saturation was reported) totals 14½ miles north and south. Maximum east - west distance of Clear Fork production in Fullerton may be about 7 miles. Although some of the Clear Fork enclosed by these limits may be marginal, engineers studying the reservoir have found the area indicated to be proven for Clear Fork oil in the upper pay to total 30,000 acres. The upper pay is considerably the most widespread.

Original bottom-hole pressure at Fullerton was 3,000 psi. To January 1, 1945, cumulative production from the Clear Fork was 3,233,258 bbl. While insufficient withdrawals and pressure decline data are available for predictions, the absence of water in outlying failures indicates that at least the first and second zones likely produce by virtue of dissolved gas (internal gas drive).

From studies of pay and reservoir data, some have placed the average ultimate recovery from the Fullerton Clear Fork at 10,000 bbl. per acre, considering the entire spread. On a total possible productive area of approximately 30,000 acres, this amounts to total of 300 million barrels of reserves. It is, of course, to be emphasized that the 10,000 bbl. per acre is the average for the total area. Estimates for the leases where the total thickness of the three pay zones nears the maximum of 250 ft. have been 15,000 to 20,000 bbl. per acre and higher. Current allowable is 118 bbl. per well per day for 18 producing days, which yields a calendar day allowable of 71 bbl. per well.

The Devonian at Fullerton has produced 27,785 bbl. of oil to January 1, 1945. Allowable per well is 180 bbl. per day for 18 producing days, a calendar day allowable of 108 bbl.

Acidizing of Clear Fork

Productivity or flow capacity of the Clear Fork at Fullerton basically is of low order and large volumes of acid are commonly used in completing wells. The different pay zones usually are acidized separately, and stage treatments are common. Total acid used per well may run from 8,000 to 20,000 gal.

In one well, data for the acid jobs and effect on productivity index are shown in Table 1.

While making the test, care was exercised to give sufficient time for maximum buildup of the static pressures. Data from such tests have led operators to conclude that adequate acid treatments in the pool will increase productivity index from 2 to 7.5 times the normal values found, and all are in favor of doing the work easily, preferably at time of original completion while the bottom-hole pressures are the highest. Details of some of the multizone, multistage acidization work will be given in a later article.

References

1. E. C. Babson, "Prediction of Reservoir Behavior From Laboratory Data," Petroleum Technology (A.I.M.E.), January 1944.
2. N. van Wingen, "A Method for Evaluating Pressure Maintenance", Petroleum Technology (A.I.M.E.), January 1944.
3. K. B. Barnes, "West Edmond Conditions Show Possibilities of Increasing Recovery by Pressure Maintenance", The Oil and Gas Journal, March 3, 1945, pp. 44-46.
4. J. H. Moore, "Fullerton Pool, Andrews County, Texas", Bull. A.A.P.G., Vol. 28, No. 10 (Oct. 1944), pp. 1,541-1,542).

TABLE 1—ACIDIZATION DATA AND EFFECT ON PRODUCTIVITY INDEX FOR A CLEAR FORK WELL AT FULLERTON

Clear Fork zone	Included interval, ft.	Acid, gal.	Productivity index, B/D/Lb. Before acid	After acid	Productivity increase
First	6,750-6,950	8,000	0.076	0.198	2.60
Second	6,950-7,100	8,000	0.145	0.362	2.50
Third	7,100-7,250	8,000	0.250	1.690	6.75

J. O. Sanders, Harvey, La., production superintendent for The California Co. in the Stella and Delta Farms fields, has been transferred to Natchez, Miss., and placed in charge of producing operations in North Louisiana and Mississippi. **Cecil Brown** succeeds Sanders at Harvey.

Dr. J. C. Ireland, on leave from Oklahoma A. & M. College, Stillwater, where he has been professor of agronomy for 17 years, is now in Bradford, Pa., to join the staff of Pennsylvania Grade Crude Oil Association. He will conduct a new phase of research based on the role of bacteria in production operations in the Pennsylvania Grade regions.

Slight traces of oil in fresh core samples can be detected instantly by its fluorescence under the Mineralight

All inspections of core samples, rotary mud, etc., must be made in as near total darkness as is possible

FLUOROCHEMISTRY— In Petroleum Science

by Jack De Ment*

INCREASED activity in coring and core analyses has intensified interest in fluorochemistry for detection of oil in drill cuttings and cores. Fluorescence has long been a well known and recognized property in petroleum refining and lubrication circles. Neither is the subject new in petroleum geology and in oil-well drilling. New applications, on the other hand, have established fluorochemistry as a valuable tool in production and completion operations.

All petroleum oils show a fluorescence or glow under ultraviolet light after their recovery and before refining. This is the property which underlies the fluorochemical method. Fluorescence is known to the trade as bloom, and a certain importance is attached to it in regard to marketability. In fact, especially prepared green-fluorescent, polynuclear hydrocarbons are often added to lubricating stock so that the proper kind of bloom will be had in the product.

The slightest trace of oil will fluoresce under ultraviolet light, even when it has been greatly diluted with mud or water, or dispersed in very small amounts throughout shale and friable earth or cuttings and cores. Hence, the use of the ultraviolet light proves of much expediency in oil prospecting.

Experience proves that an ultraviolet lamp is a good field instrument for geologists. Recommendations for setting casing are usually based on microscopic data, odor of the core, core analyses, electric logs, etc. As an example of the application of the fluorescence property in this field, in one Louisiana pool an ultraviolet lamp was employed on six wells. It gave correct results on about 50 cores containing six or more gas-oil or oil-water contacts. Such results have been obtained by many petroleum geologists in numerous fields. In addition to examining crude oils with such a lamp, examination can be made for formation samples from drilling wells and various miscellaneous materials.

The fluorescence analysis of petroleum has a very practical importance in industry. Though the primary purpose of an ultraviolet lamp may be to determine the presence or absence of petroleum in subsurface formations, it can also be used either in the field or in the laboratory. In both instances the lamp may be employed to examine the cuttings or cores or a formation penetrated by the drill.

Fluorescence of crude petroleum is excited by ultraviolet light of wavelengths down to 2,000 Angstroms, though the so-called "near ultraviolet", that approximating 3,650 Angstroms, is recognized as creating a brighter fluorescent response in this substance. The source of ultraviolet light which releases a preponderance of the "near ultraviolet" is that often chosen for the prospecting of petroleum in the field, and also for more refined laboratory studies of various samples taken in the field.

However, there are certain advantages in the quartz-mercury arc or short-wave lamp, which releases much of its light at 2,537 Angstroms, for it can be employed efficaciously for sands, shales, drillings, and cores, not only to detect petroleum, but also to reveal the presence of other formations or for detecting economically important minerals which do not fluoresce with the "long-wave lamp".

In all operations with the ultraviolet lamp, a special glass filter

*Research chemist, Fluorescence Laboratories, Portland, Ore.

The Mineralight is a portable battery-operated unit. Inspection cabinet contains all necessary equipment

Any prospector or mining engineer can readily determine presence of scheelite and the approximate quantity

must be used to eliminate the visible light created by the lamp, and at the same time allow the invisible ultraviolet to pass through.

There have been a number of statements made relating to the delicacy of the fluorescent method. It is known that one part oil dissolved in 100,000 parts carbon tetrachloride fluoresces enough so that an observer can easily see it. Dispersed in soil, oil concentrations corresponding to a few parts per million can be seen by a careful observer. If the eye is supplanted with a photoelectric cell, the oil in a solvent may be diluted out to one part in many millions and still be appreciated.

The factors entering into the production of a certain appearance or fluorescent pattern, either visual, photographic or instrumental, under filtered ultraviolet light, are so complicated that identity of appearance is strong evidence of composition, source, history and often many of the properties of any two or more objects. This statement is axiomatic in fluorescence analysis and though it embraces all the fields covered by this science, there is no reason to believe that it does not hold equally true for oil studies.

However, it is widely concluded that no two specimens of petroleum show the same quality, i.e., color, and quantity, i.e., brightness of fluorescence under ultraviolet light unless they are from identical sources. This is true for both different zones of the same drilling, and for wells in different localities.

In most specimens of oil-bearing earths differences in fluorescences are easily noted with the unaided eye. For more accurate work, say

Research chemist and technical-book author, Jack De Ment is head of Fluorescence Laboratories, Portland, Ore. His specialties are fluorescence and phosphorescence, radiation science, uranium minerals, luminescent materials, ultraviolet light, rarer metals, all as applied to the arts, sciences, and industries. He is credited with having named and established the science of fluorochemistry, and enunciating its basic law. He attended Reed College from 1938 to 1941, has authored or coauthored 10 books dealing with luminescence and related sciences, and nearly 200 articles in domestic and foreign periodicals. He is associate editor of the Mineralogist, and is affiliated with numerous scientific and professional societies. He has ready for publication a dictionary of luminescent substances covering nearly 20,000 items.

in the laboratory, the quality of the fluorescent light can be appraised with color screens or filters, a hand spectroscope, or a spectrograph; the quantity of fluorescent light can be determined with filters of various transmission, a photoelectric photometer, or a spectrophotometer. Most laboratories possess one or more of these devices, and when one is familiar with their operation, one can apply them to petroleum work.

Causes of Deviation

While petroleum might show a medium or deep blue fluorescence, it can deviate slightly or greatly from this color, according to the source, the condition of sample recovery, and the ultraviolet lamp used. The appreciation of colors by the observer will of course enter more or less into the picture. If oil is absorbed into a dark colored core or cutting, or if certain other factors exist, the fluorescence may have a variety of shades: sometimes fluorescence of low intensity, together with the color of the bearing material will give variable results.

Some of the fluorescent colors, of different brightness, which have actually been observed in petroleum-bearing earth include: blue-green, green, pea green, dark olive green, greenish, blues of different hues, blue-white, cream-white, and purple or blue-purple.

A few examples will make this clear: core samples from certain Louisiana drillings fluoresce yellow to green-yellow—cores from producing formations give a very brilliant yellow glow, but those from a fluid-rich gas-producing zone have only a dull yellow fluorescence. From a dry gas zone or a salt water producing formation there is little or no fluorescence seen. However, in cores from a zone which is at an oil-water contact, a spotted fluorescence, irregular yellow patches on a dark background, is observed.

When an ultraviolet lamp is used directly at the well on cores immediately after they have been taken from the core barrel, rapid analysis is secured. A dried out core gives no fluorescence. In the case of a well drilled through two or more hori-

DIGITIZED BY MICHIGAN LIBRARIES

Applicator is easily held in the hand and has sufficient safeguards over the filter and quartz tube to protect these vital parts. The filter is easily removed by opening the bar and sliding the filter out

zons, the various producing zones can sometimes be distinguished by their fluorescences. It is important to know whether all of the zones contribute to the production of the well, or whether only one of them does. By examining the well's oil a determination might be made of whether the oil is from a particular zone or zones and thus determine which sands are not producing.

When a well is drilled in any particular field, and samples of the various sands penetrated are tested and suitably classified, the record obtained becomes an index for that field. When subsequent wells are drilled, the new samples may be compared with the index and correlated accordingly, though it is necessary that samples tested consist of oil or of sands bearing oil.

Technique

There are several techniques available for detecting oil or correlating sands or shales by ultraviolet light. The more popular and easily manipulated of these can be grouped as follows:

1. **Prospecting.** — The sample as obtained is placed under ultraviolet light in darkness and the fluorescence, if any, observed with the unaided eye. Best observations are made by viewing the sample at right angles to the lamp and after the eye has allowed itself to be adjusted to night-vision by remaining in the darkness for some minutes beforehand.

The mud, drillings, sand, or other specimen is placed in a dish or testtube which does not fluoresce, alongside a similar vessel containing a dozen or so drops of known-fluorescent petroleum in carbon tetrachloride. The two are inspected simultaneously.

If the sample consists for the greater part of water or of mud and water, it is advised that a wide-mouth vessel, like a nonfluorescent metal pan or bowl, be used. In this case the sample is allowed to set for several hours or overnight before the examination is made.

If oil is present droplets will rise to the surface and form a thin film or appear as droplets, and these can be seen under ultraviolet light. When using a wide-mouth bowl a comparison sample is viewed alongside the unknown. This comparison sample is prepared by dropping a few drops of petroleum (crude) onto the surface of water or mud which does not fluoresce. Pyrex dishes can also be used in this method, but they should be placed upon a sheet of black, nonfluorescent paper or cloth.

The preceding method is representative of the most elementary and cursory of the tests available. One should practice with known samples having different amounts of oil present so that the fluorescence in an unknown can be recognized. The above method is also of somewhat restricted sensitivity: where the fullest appreciation of a qualitative test is desired the following technique can be employed.

The sample of mud or water as obtained is thoroughly shaken with carbon tetrachloride, using about equal volumes of each, and the two allowed to separate by setting for a short time. The carbon tetrachloride, which takes up any oil present, is then carefully separated from the remaining material and filtered through medium or fine grade paper. This is done to eliminate extraneous matter which may have passed along with the carbon terachloride when it was separated from the sample: also, it will give an indication of whether or not the sample and solvent have been allowed to set long enough for separation.

If the filter paper shows wet spots, particularly near the cone, after it has been freed of carbon tetrachloride by standing in the air for a few minutes, one can assume that there is water present in the extract and that the separation of water and solvent have not been complete. Small amounts of water carried along with the solvent (which contains the oil) may impart a bluish fluorescence which might be mistaken for a low concentration of oil. Also, great care must be taken to obtain carbon tetrachloride which is completely void of any fluorescence: many commercial grades of this solvent have a slight blue luminescence and this, added to the blue and purple light passed by the filter on the lamp, may give false results.

To get an idea as to how much petroleum may be in a given sample, extracted by the above method, the ultraviolet examination is made by using standards containing known concentrations of crude oil in carbon tetrachloride. The standards can be made up arbitrarily, by adding successively, 1, 2, 3, 4, . . . drops of oil to 15-20 cc. of solvent and diluting out if lower concentrations are desired. It is convenient to make up standards in two sets of 15 each. One set is kept in the darkness as a reference series and the other is used in the actual comparison, though in use excessive exposure to the lamp is avoided.

Depending upon the oil concentrations of the samples being worked with, different values of concentration are given each item in the series. For general purposes the sets can have known oil concentrations corresponding to 0.5, 1, 2, 4, 6, 8, 10, 12, 18, 24, 30, 34, 40, 60, and 80 parts per million. One drop of oil is about 0.05 cc. Other concentration ranges can be made up as desired. A stock solution of 100 or more p.p.m. can be made up in larger amounts to prepare subsequent standards from.

The standards are kept in 10 or 20 cc. nonfluorescent glass bottles. New cork stoppers are used, but not rubber stoppers, for rubber contains fluorescent materials which dissolve off into the carbon tetrachloride. When not in use they are protected from the light. All bottles must be of the same size and shape, and the unknown is viewed in a similar bottle alongside the standard.

2. **Correlating.** — In quantitative work the previous extraction method is employed, except that care is taken to weigh the sample and measure the volume of solvent used to extract the sample with. When the fluorescence is feeble or questionable part of the solvent is allowed to evaporate off, so raising the concentration of any oil that it may contain. Just prior to the inspection, however, the remainder of

the extract must be measured and computations based on the total.

The comparison method, using an oil extract, should be well practiced in the laboratory before starting on unknowns if correlations are to be made at a later time. For prospecting it is not as important to follow the rules closely, for the criterion is merely the fluorescence and its approximate brightness and color. In obtaining a representative value of the oil present several samples, up to six or more, should be taken from the same locality, or at least until approximately reproduceable results have been obtained. The method is likewise applied to other localities or areas which are to be correlated.

The amount of oil can be expressed in several ways, as parts per million, in per cent, or by arbitrary fluorescence standards. None appears to have any particular advantage over the other, with perhaps the exception of the latter.

3. Fluoroanalysis of drill core.—By simply placing a portion of drill core under an ultraviolet lamp and noting the fluorescent response, an indication of oil and of other specific minerals which may be present, and which might otherwise be overlooked, can be gotten. The short wavelength lamp proves the more satisfactory for duties of this nature, for valuable tungsten, zinc, and uranium ores are readily recognized by their fluorescence under the type of ultraviolet radiation generated by this class of light units. However, if a blue fluorescence, known to be due to petroleum, is observed on the core, and the existence of other minerals occurring in the core is to be ascertained, the sample should be wiped free of oil or washed in solvent and dried.

A Specialized Field

If a strong blue, white, yellowish, or mixture of these colors is seen in a drill core sample under the lamp, there is a good indication that one of the economic tungsten-bearing ores may be present: in such a case the matter can be further looked into by other means. In zinc ore either a brilliant green or orange fluorescence, due to willemite and sphalerite respectively, will be observed. For the uranium minerals yellow, green, yellow-green or varying hues of these fluorescences will be seen in many instances.

The recognition of specific minerals by their radiation-response is a rather specialized field, one which can be properly understood from a study of the recent literature on the subject of fluorochemistry, and a field which must be taken into consideration whenever ultraviolet light and the fluorescence it creates in petroleum and other substances found in the earth are under exploration.

In checking oil cores the fluorescent analysis should be made while the core is fresh and not after it has dried out. A fresh core can contain oil which will readily fluoresce with the ultraviolet light but after this same core has dried out the fluorescence will disappear.

Ultraviolet is also helpful in many cases where the strata or dip is difficult to locate. In this particular problem different strata will respond with varying shades of color while under visible light no difference can be detected. This particular application of ultraviolet fluorescence should be made with both the long wave-length and short wave-length lamps as many sands and gravels respond to either one of these wave lengths but not to both.

Literature

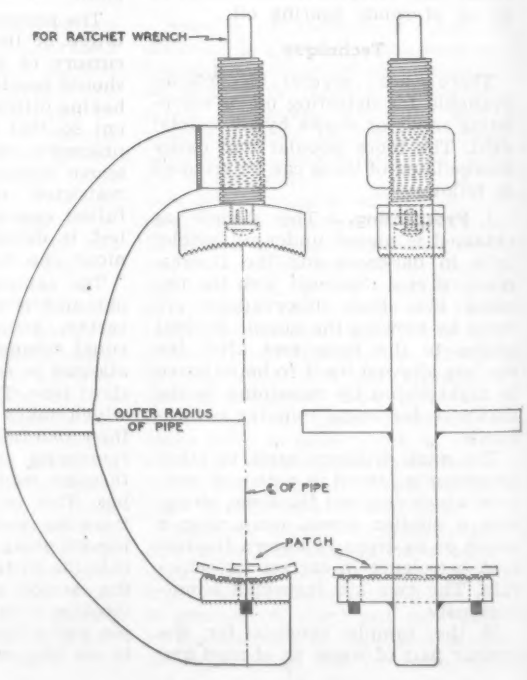
For a background of the subject see De Ment, Fluorescent Chemicals and Their Applications, New York: 1942 (2d. edn. in 3 vols. available in 1945); Ultraviolet Light and Its Applications, New York: 1942; Fluorescent Light and Its Applications, New York: 1941; Fluorochemistry, New York: 1945 (in press); Fluorochemical Analysis, New York: 1945 (in press), (all published by the Chemical Publishing Co., Brooklyn, N.Y.). See also Radley and Grant, Fluorescence Analysis in Ultraviolet Light, New York: 1939 (3d. edn.) The Oil Weekly, 103, 17-19 (1942); Refiner & Natural Gasoline Manufacturer, 21, 81 (1942); 21, 80-90 (1942); Petroleum Refiner, 22, 83-85 (1943); 23 (1944).

Substantially Built Pipe-Line Tool

AN improved-type pipe-line repair clamp, developed by C. E. Wharton and V. H. Jones, the Hanlon Gasoline Corp. of Texas, is shown in the accompanying drawing. Designed primarily to repair leaks in pipe lines handling highly volatile fluids such as propane or butane, the tool may be found useful in repairing small leaks in pipe lines handling other materials.

Proportions of the various component parts of the clamp for all pipe sizes are as indicated by the drawing: Dimensions of the clamps vary with each pipe size. Materials used in construction are mild steel for the main body, SAE 3140 or equal for the clamp screw and nut and SAE 6150 or equal for the serrated jaws. After welding the clamp nut to the main body, the assembly should be annealed, machined and heat treated to the desired hardness for the nut. The jaw pieces are hardened to around 35-40 Rockwell-C after completion of the machining operations.

Patches made from ¼-in. or heavier plate or from a section of pipe may be used as desired when formed to the outside diameter of the pipe for which they will be used. Cemented to the steel patch, near its center, a section of ⅛-in.-thick neoprene or similar material serves to plug the opening when the patch is forced tight against the pipe by the clamp screw. The two pins which are tackwelded to the back side of the steel part of the patch are for anchoring it to the tool while it is being placed over the leak. Studs instead of plain pins may be used to bolt the patch to the fixed lower jaw of the clamp if desired. Permanent repair is made by fillet welding the patch to the pipe.



QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Plasticity of Wax

What is meant by the plasticity of a wax?—E.A.P.

The vernacular of wax technology is by no means well defined. A number of terms such as ductility, flexibility, plasticity, length, "feel", or even "hand" have somewhat similar meanings. In a most general way brittle waxes are said to be nonductile or to lack the property inferred by the terms enumerated above. Perhaps the most widely used term for these properties is "ductility". There is, however, no standard test method that is widely used for measuring ductility, although various shop methods have been devised for comparing the suitability of waxes for a special service. A test method has been proposed by which a standard briquet is pulled apart somewhat as in a tensile-strength test except that the load is applied for a long length of time (even several hours). The test is conducted at a carefully controlled temperature and the magnitude of the load is kept constant.

The melting range of a wax appears to be related to its ductility. A somewhat wide (but uniform) range of melting point indicates a ductile wax, and waxes which are composed of uniform distribution of components of different melting points are more ductile.

Temperature affects the ductility, the ductility being generally greater at high temperatures. Nevertheless, in the case of paraffin wax the greatest ductility often develops at a temperature of 40° to 50° F. below the melting point. This is perhaps due to the disappearance or transition of one type of crystalline structure to another. Somewhat the same behavior can be produced in a wax by mixing waxes of different melting range or of different crystalline structure.

Finally, the microcrystalline or so-called amorphous waxes have more flexibility than the more crystalline paraffin waxes. Although these waxes can hold more oil without tending to sweat or become greasy, their flexibility or ductility is not greatly affected by the amount of oil contained in them.

Brittle waxes can be made somewhat more ductile by compounding them with the microcrystalline waxes or petrolatum. Such compounding agents must of course be miscible with the hard wax. Butene polymers such as Vistanex help the ductility of paraffin wax to some extent.

Equilibrium Constants Of Olefins

Can you direct me to data on the equilibrium constants of olefins in mineral seal oil? Your Petroleum Refinery Engineering does not seem to be concerned with the absorption of cracked gases such as those encountered in refineries which contain both paraffins and olefins. R.J.P.

With respect to low-pressure absorbers (20-100 psig.) the vapor pressures of the olefins may be used to compute equilibrium constants by dividing the vapor pressure by the operating pressure. For such a purpose the chart shown in The Refiner's Notebook No. 38 (The Oil and Gas Journal, April 21, 1945) may be used.

The practical and necessary answer with respect to equilibrium constants for high-pressure absorbers and many fractionation operations is that the equilibrium data now published in Petroleum Refinery Engineering and elsewhere are not adequate. Thus, if the data on the normal paraffin hydrocarbons and the somewhat impure mixtures encountered in industry, are not adequate, then it is certain that the behavior of the olefins cannot be accurately stated because relatively little information regarding them is available. Nevertheless, no notable differences in the behavior of olefins and paraffins have been noted in commercial petroleum-refinery absorbers. In connection with fractionators there is some indication that the olefins are separated more effectively than their relative boiling points would indicate, but the difference in behavior is so slight that it is of no practical significance. A comparison of the rate of change of vapor pressure with temperature indicates that the normal olefins behave almost exactly as the normal paraffins behave, and that the isoparaffin hydrocarbons deviate to a small extent from the behavior of the normal paraffins.

Few experimental data on the vapor pressure or equilibrium constants of the olefins are available. Experimental equilibrium constants on propylene and isobutylene have been published by Gilliland & Scheeline (Ind. Eng. Chem. 31, 1050, 1939, and 32, 48, 1940). Charts from which the constants can be computed may be obtained from C. G. Kirkbride of A. & M. College of Texas (College Station) and these charts are discussed in "Hydrocarbon Phase Equilibrium Calculations" which appeared in the January 1945 issue of Petroleum Refiner. Vapor pressures (or their equivalents) for ethylene and propylene are presented by Gamson & Watson in "High-Pressure Vapor-Liquid Equilibria" (Nat. Pet. News, Sept. 6, 1944) and of course the vapor pressures of these hydrocarbons are given on almost any vapor pressure chart. A recent list of references on the vapor pressures of ethylene and propylene is given by R. V. Smith on page 88 of the February 1943 issue of Petroleum Engineer. Finally, the vapor pressures of eight olefin hydrocarbons are given by Lamb & Roper (J. Am. Chem. Soc. 62, 806, 1940) and their data are presented in nomographic form by D. S. Davis in Ind. Eng. Chem. 33, 553, 1941.

What Is a Stripper?

You speak of steam being used in a stripper. We have strippers and do not use any steam. Can you explain this? G.R.L.

In a dictionary sense the word "stripper" may be used as a general term to describe any operation by which the lowest boiling portions of a stock are removed. One refiner puts it, "anything that fixes the front end." Thus, a fractionator that is used mainly for the removal of a small amount of light material is often referred to as a stripper. In chemical-engineering vernacular, the part of a fractionator below the feed plate is called the "stripping" or "exhausting" section of the tower.

Although such usages are common and for this reason proper, perhaps the best definition of a stripper is "an operation by which a liquid is contacted in a counter-current manner with an inert gas for the purpose of removing volatile components from the liquid." Inasmuch as steam is the most common stripping agent or inert gas, many technologists refer to a steam stripper simply as a stripper.

Stripping by means of an inert gas is always more effective at high temperatures and hence many steam strippers are in reality a combination fractionator and stripper. Thus, the term "stripping-still" used in the natural-gasoline industry to describe the heating, fractionating, and stripping of gasoline from rich absorptin oil is an excellent and discriminating usage.

The T.C.C. Catalytic Cracking Process For Motor-Gasoline Production

by R. H. Newton, G. S. Dunham,† and T. P. Simpson‡*

ABSTRACT

Although the basic fundamentals of catalytic cracking are not extremely complex, the engineering details necessary to successful commercial operation have required a vast amount of study. The T.C.C. process is characterized by separation of the reaction and regeneration zones and continuous movement of a solid catalyst through each. The factors governing rate of flow of pellet catalyst in beds, and methods of insuring uniform flow and distribution have been studied experimentally in plant scale models. The characteristics of the cracking catalyst require a minimum temperature of about 900° F. to burn off the coke deposit, in order to regenerate the catalyst; and also dictate a maximum temperature of not over about 1,200° F., in order not to damage the catalyst. These requirements are satisfied by stepwise burning and cooling, and limiting the temperature in any zone by control of the oxygen supplied.

It is believed that the characteristic design of equipment and the application of simple engineering principles is not limited to the cracking of petroleum. Wherever a solid catalyst is contacted with vapor in a regenerative process, and the reaction pressures do not exceed approximately 2 or 3 atmospheres, the T.C.C. principle would appear to be applicable.

THE first commercial catalytic cracking units employed the Houdry fixed-bed principle. These plants, now numbering about 30, demonstrated the technical feasibility and economic advantages of catalytic cracking.

During the development and commercialization of the fixed-bed units, Socony-Vacuum Oil Co., Inc., instituted research on the design of a unit employing the moving-catalyst principle, and carried this program through to the successful installation and operation of 34 commercial units. Today Houdry Process Corp. offers for licensing these two processes employing the same basic principles, but differing in application.

There are a number of distinctive chemical engineering features of the process, which required careful laboratory study in establishing the proper design. The size of catalyst particle chosen was 0.1 to 0.2 in. in diameter and was determined as sufficiently large to be conveniently manufactured, and of proper size to permit ready flow of vapors through a bed, and at the same time, permit proper diffusion into the individual particles. The problem of handling such material and distribution of flow, both of solid and of vapors, received a great deal of attention. The over-all design of commercial-sized plants showed elevators of about 200 ft. lift to be necessary. Such elevators operating as a single lift for transporting catalyst at 900°-1,000° F. were designed through cooperation of Jeffry Manufacturing Co., Lummus Co., and Socony-Vacuum Oil Co., Inc. Operating experience to date has been very satisfactory. To insure smooth vertical downward movement of catalyst, the rate of flow of oil vapors through the bed must be controlled below that point where "boiling" begins. In practice the maximum premissible pressure drop is somewhat less than the weight of catalyst. The pressure drop through beds of catalyst is found to agree well with the data published by Chilton and Colburn,[1] when corrected for average inlet and outlet conditions. Obviously, the lifting or boiling effect is most pronounced where the oil vapor leaves the catalyst, since the molecular weight is the lowest at this point. The pressure drop through a deep bed is of considerable help in producing uniform flow throughout the bed; however, it is generally felt that provision for uniform distribution should be made at the inlet and outlet points.

Another engineering factor of considerable interest is the distribution of flow of catalyst particles to insure vertical movement of the bed. Laboratory experiments were made to determine not only the rate of catalyst flow through various openings, but also the type of flow. It was found that when there was a single opening in the center of a vertical cylindrical vessel, 24 in. in diameter or less, the flow of catalyst was vertical whenever the depth of bed exceeded 1.5 times the diameter of the vessel. At the lower depths, appreciable coning occurred, and there was visible crossflow of catalyst. This condition necessitated that a bed depth of at least 1.5 times the spacing of the distributor holes be allowed above the flow control plate. The type of flow observed in these experiments was extremely interesting and is illustrated in Fig. 1. The diagram shows several successive positions of the surface of the pellets. When the depth exceeds 1.5 times the diameter of the container, the surface is horizontal and moves downward uniformly. If the bed depth exceeds 1.5 times the diameter, the material outside a cone of included angle 38° is substantially stagnant. The apparent angle of repose is 71°, as compared to the static measurement of 34°. As the level of the catalyst drops, a cone appears in the center, the diameter of which is approximately determined by the apparent 71° angle of repose. Outside of this point, the surface remains level by a horizontal motion of the catalyst particles. At an average height between one-half and one diameter, the exterior part

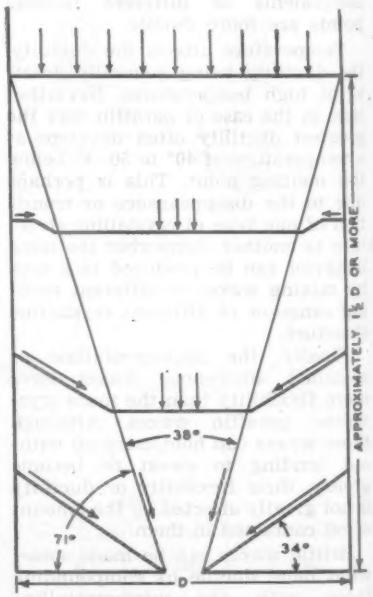


Fig. 1—Catalyst flow diagram

Presented at the St. Louis, Mo., meeting of the American Institute of Chemical Engineers, November 19-21, 1944.

*Houdry Process Corp., Marcus Hook, Pa. †Socony-Vacuum Oil Co., Inc., New York, N. Y. ‡Socony-Vacuum Oil Co., Inc., Paulsboro, N. J.

of the cone assumes a static angle of repose of 34°, and the motion is parallel to the surface. As before, the area within the 71° apparent angle of repose moves substantially vertically downward.

The rate of flow of catalyst from any orifice is generally restricted by the catalyst below, but it was essential to know the limiting maximum rate of flow. The following equation was found to express the experimental data:

$$F = 8.50D^{2.96}H^{0.04}$$
$$f = 10.8D^{0.96}H^{0.04}$$

or where

F = catalyst flow in lb. per minute
D = diameter of orifice in in.
H = head in ft.
f = catalyst flow in lb./min./sq. in.

This relationship is unique as far as is known. It shows that head has almost no effect, whereas the flow is directly affected by the diameter of the hole as well as its area. This formula holds where the diameter of the hole is greater than 6 times the particle diameter. Below this diameter, flow is very irregular. A plot of the experimental data is given in Fig. 2.

In order to check these flow experiments, transparent models were made to full commercial dimensions, and the catalyst flow carefully observed by use of multicolored pellets. This allowed considerable assurance that the methods of control of catalyst flow were sound.

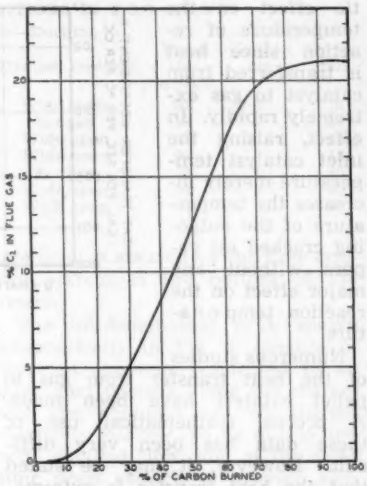


Fig. 3—Combustion of carbon deposit at atmospheric pressure, temperature at 1,000° F.

In the regeneration phase, it is essential to maintain a given minimum temperature to insure the initiation of combustion and also to limit the maximum temperature to about 1,150 F., to prevent excessively rapid deterioration of the catalyst. The present design calls for alternate burning and cooling zones to accomplish these aims.

The rate of combustion of the carbon deposit on catalyst pellets has been studied carefully for the various types of regenerating equipment. The utilization of air, at several rates of flow, is shown as a fraction of carbon burned in Fig. 3, as an illustration. When the air is first passed through a bed of catalyst at the rate used, the oxygen in the air is substantially completely consumed. This condition persists until about one-third of the carbon is burned, then the oxygen concentration rises with a decreasing rate of combustion. When about 70 per cent of the carbon has been burned, the rate of combustion is relatively slow, and the carbon remaining is completely cleaned up by a longer exposure. Thus the rate of combustion in the upper portions of the kiln is determined largely by the rate at which air is furnished to each section. In the center sections, the air is incompletely utilized, and in order to make the best use of it, it is essential that the temperature of the catalyst be as high as possible within the limits set by catalyst stability. The lower sections provide a sufficient holding time in accord with the description of combustion given above.

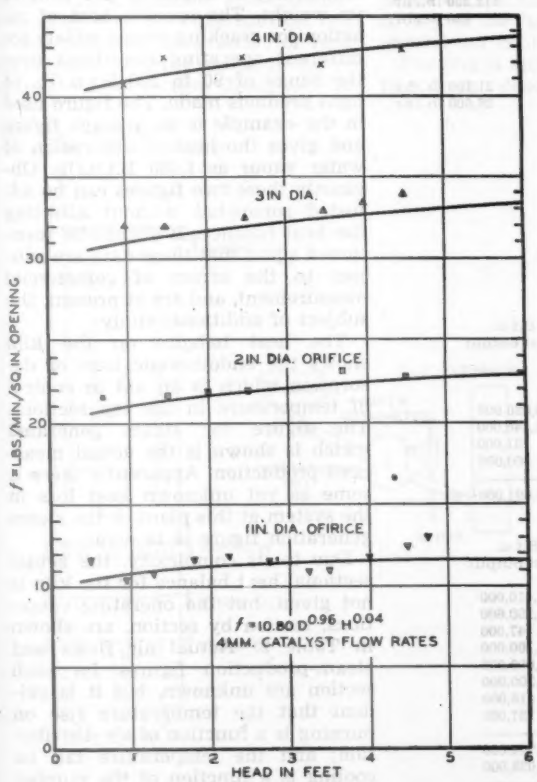


Fig. 2

The amount of carbon that can be burned in each combustion zone depends on the limits of inlet and outlet catalyst temperature for each zone. For a plant having a catalyst circulation of 100 tons per hour, it is possible to remove 5,000,000 B.t.u./hr. from each section by allowing the catalyst temperature to rise 100° F. If no heat is removed by the air stream, this corresponds to a combustion rate of 375 lb./hour of carbon in the section. However, it is preferable to use cold regeneration air in the upper zones where combustion is rapid; the additional heat removed in heating this air from atmospheric amounts to about 1,500,000 B.t.u. hour; so that 30 per cent more carbon can be burned, making a total of 464 lb./hour per section. Presently, operating kilns have from 7 to 10 burning sections.

Another factor of considerable importance in the operation of the T.C.C. unit is the isolation of the oil system from the air by means of pressure seals or inert gas. It is a well-known fact that a pressure differential can be maintained across a pipe full of catalyst particles by maintaining a flow of gas through it. This is exactly the principle employed in sealing the top and bottom of the reactor. The top and bottom differ, however, in that at the top, the flow of sealing gas and catalyst are counter-current, and in order not to stop the downward flow of catalyst, the gas flow must not exceed that giving a pressure drop of about 6 in. of water per foot of height. Thus allowable minimum pressure drop is about 70 per cent of the weight of catalyst per foot of height. In laboratory studies, the flow of catalyst in a smooth container is not ordinarily interrupted by a flow of gas until the pressure drop equals or exceeds the weight of catalyst. However, once the flow is stopped or "bridging" has occurred, the pressure drop must be decreased appreciably to reestablish flow. The use of a maximum figure of 70 per cent of the weight for allowable pressure drop permits a factor of safety to take care of gas surges, and except in very unusual circumstances, allows the catalyst flow to reestablish itself when the pressure surge subsides. As mentioned before, this pressure drop

may be calculated with sufficient accuracy from the data of Chilton and Colburn.[2]

An over-all heat balance for the operation of both reactor and kiln is given in Table 1. There are still several factors of the heat balance on commercial units that are under investigation since they are not clearly understood. These data were obtained from a commercial plant of somewhat different internal design from the one discussed. However, it serves to show the magnitude of quantities of heat being considered. In the reactor, the heat of reaction, which is endothermic, is furnished from two major sources—heat in the entering oil vapors, and heat of hydration of the catalyst by steam. In a counter-current flow system, when the ratio of catalyst flow to oil flow is 2.0 or less, the temperature at which the catalyst enters the reactor has relatively little effect on the temperature of reaction since heat is transferred from catalyst to gas extremely rapidly. In effect, raising the inlet catalyst temperature merely increases the temperature of the outgoing cracked oil vapors without any major effect on the reaction temperature.

Numerous studies of the heat transfer from gas to pellet catalyst have been made. A precise mathematical use of these data has been very difficult. However, it may be stated that the heat transfer is extremely rapid and is in general agreement with published results of similar studies. Following the correlation method adopted by Furnas,[3] the coefficient for heat transfer from gas to catalyst was found to vary from 0.003 to 0.013 cal./sec./°C./cc., and the "material coefficient" A was found to be 0.05, which is well within the limits for various substances. Fig. 4 shows the experimental data together with a curve calculated from Furnas' data using A = 0.05. The only condition at which an appreciable difference between temperature of the catalyst and hydrocarbon vapors can exist is at a location where the temperature gradient along the height is very steep.

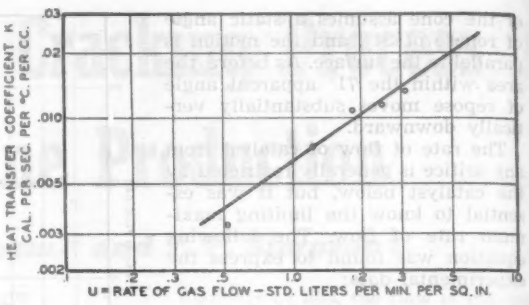


Fig. 4

TABLE 1—TYPICAL T.C.C. HEAT BALANCE

Charge rate	8,751 B/D		
Gravity	31 A.P.I.		
Oil and steam to reactor		935° F.	
Vapor temp. from reactor		950° F.	
Catalyst to reactor		995° F.	
Catalyst from reactor		875° F.	
Steam to vaporizing section			4,200 lb./hr.
Steam to stripping section			3,200 lb./hr.
Gas products	6.7% Wt.		7,500 lb./hr.
BB cut	9.4% Vol.— 6.1% Wt.		6,800 lb./hr.
Gasoline	40.8% Vol.—35.2% Wt.		39,400 lb./hr.
Total cracked products			53,700 lb./hr.
Coke produced			4,150 lb./hr.
Gas oil			54,400 lb./hr.
Reactor charge			112,250 lb./hr.
Adsorption of H_2O in reactor			830 lb./hr.
Catalyst circulation	106 Tons/Hr.		
Catalyst to kiln		865° F.	
Catalyst from kiln		1,005° F.	
Steam generation			21,100 lb./hr.
Air to preheater 18,100 C.F.M. @		60° F.	86,600 lb./hr.
Air to kiln preheated to		501° F.	
Air leaving kiln		978° F.	
Flue-gas analysis	9.2% CO_2		
	6.6% O_2		
	4.0% CO		
	80.6% N_2		
	11.7% H_2O Vapor % Gas Vol.		
H/C ratio in coke = .089			
CO_2/CO ratio in flue gas = 2.3			

REACTOR BALANCE
Basis—1 Hour

	B.t.u. heat input	B.t.u. heat output
Catalyst	6,350,000	
H_2O absorption	1,290,600	
Carbon on catalyst	50,400	
Heat of cracking		6,020,000
Oil products		1,140,000
Steam		31,000
Heat loss est.		500,000
	7,691,000	7,691,000

KILN BALANCE

	B.t.u. heat input	B.t.u. heat output
Carbon burned	64,800,000	
Catalyst		7,410,000
Desorption of H_2O		1,290,600
Temp. Inc. of desorbed H_2O		47,000
Steam generated		21,100,000
Est. heat loss		8,000,000
Air to kiln		10,300,000
H_2O in air to kiln		413,000
H_2O from combustion		187,000
Accounted for		48,762,000
Unaccounted for		16,038,000
	64,800,000	64,800,000

Specific Heat of Reaction

It is interesting to note that the data show the absorption of 830 lb./hour of water by the catalyst, amounting to about ½ per cent of its weight. The specific heat of reaction for cracking varies widely for different operating conditions over the range of 90 to 200 B.t.u./lb. of light products made. The figure used in the example is an average figure and gives the heat of absorption of water vapor as 1,580 B.t.u./lb. Obviously these two figures can be adjusted somewhat without affecting the heat balance. It should be mentioned again that these data are subject to the errors of commercial measurement, and are at present, the subject of additional study.

The heat balance on the kiln shows the endothermic heat of desorption which is an aid in control of temperature in the top sections. The figure for steam generated which is shown is the actual measured production. Apparently there is some as yet unknown heat loss in the system at this plant or the steam generation figure is in error.

Due to its complexity, the actual sectional heat balance for the kiln is not given, but the operating conditions, section by section, are shown in Table 2. Actual air flows and steam-production figures for each section are unknown, but it is evident that the temperature rise on burning is a function of air distribution; and the temperature fall on cooling is a function of the number of cooling coils in service.

TABLE 2—OPERATING CONDITIONS IN T.C.C. KILN

Catalyst temperatures				Burning		Cooling	
Burning zone		Cooling zone					
Inlet approx.	Outlet	Inlet	Outlet	Damper position	Temp. rise approx.	Coils in use	Temp. fall
915	1,005	1,005	995	Wide open	90	0	10
995	1,040	1,040	960	⅜ open	45	2	80
960	1,040	1,040	975	Wide open	80	1	65
975	1,065	1,065	1,020	Wide open	90	1	45
1,020	1,050	1,050	1,010	⅜ open	30	1	40
1,010	1,070	1,070	1,025	Wide open	60	1	45
1,025	1,065	1,065	1,010	Wide open	40	1	55

Mechanical Design of Plant Reactor

The cracking plant itself is simple in design and operation. The heaters, coolers, distillation equipment, and gas plant are conventional and common to many operations in petroleum refineries. The reactor vessel, shown in Fig. 5, is unique in the distribution of the oil vapors, the means of sealing the top and bottom, the catalyst flow control system at the bottom, and the purge system.

The clean regenerated catalyst is introduced into the reactor through a vertical leg, which provides sufficient head of catalyst to flow into the unit against the operating pressure. A top seal is provided by introducing flue gas into the catalyst distributing chamber under sufficient pressure to prevent hydrocarbon vapors from entering this zone and subsequently leaking out through the feed leg. The flue gas is generally prepared in an inert gas generator, in order to have the minimum oxygen content. The distribution of catalyst over the catalyst bed is accomplished by a series of feed pipes, each covering about 10 sq. ft. of area. Uniform flow downward at this level is assured by the flow control system at the bottom of the vessel.

The oil-distribution grid, shown schematically in Fig. 6, consists of inverted channels connected to an inlet duct passing along the diameter. The channels are constructed relatively narrow, so as not to impede catalyst flow, and at the same time deep enough to provide adequate cross section to avoid excessive drop along the channel.

Catalyst Purging

The catalyst which passes over the feed grid is coated with a deposit of higher-boiling constituents of oil, some of which have been converted to a dry coke. However, cracking is still progressing, and it is essential to decrease the concentration of carbonaceous matter on the catalyst as much as possible. Not only would it be wasteful to admit into the regeneration zone spent catalyst having liquid oil on its surface, but an additional burning load would be imposed on the kiln. Furthermore, recovery of the "purge oil" amounts to several per cent of usable liquid oil.

Purging is apparently composed of two steps: desorption of liquid oil from the catalyst, and sweeping of the oil vapors from around the catalyst particles. The time for purging is relatively short, and uniform distribution of steam through the catalyst is important. The purge steam distribution system is combined with the upper flow plate of the catalyst flow control system, as shown in Fig. 7. This flow plate contains several concentric rings of holes each four inches in diameter. The center-to-center distance along the circumference is short, and the distance between the pitch circles is about 18 in., which insures uniform catalyst flow at all points higher than about 27 in. above the plate. The catalyst collects beneath the plate according to its angle of repose leaving a vapor space for introducing the purge steam, and at the same time providing a seal and equalization of pressure across the cross section. This insures equal distribution of the purge steam to each of the 400 odd holes.

The catalyst-flow plates have already been mentioned. In principle, the number of rings of holes is decreased at each succeeding lower plate. The center lines of the lower

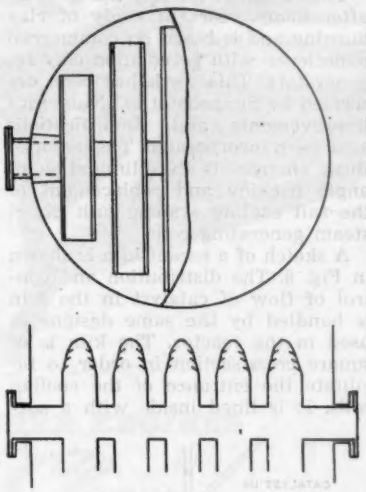


Fig. 6—T. C. C. reactor—oil-feed grid

holes are midway between the two circles above. Thus, the lower ring of holes collects catalyst equally from each of the two rows above, permitting a decrease in diameter to a single catalyst outlet. See Fig. 7.

The catalyst leaving the reactor passes through a depressuring pot, to allow the escape of steam which is removed by a small jet condenser. Inspection of the condensate stream for traces of oil provides a convenient check on the completeness of purge.

The temperature conditions in the reactor are such that a simple cylindrical steel vessel can be used, and the insulation placed outside the shell. The vessel can be fabricated in accordance with the A.P.I.-A.S.M.E. code in all respects. For

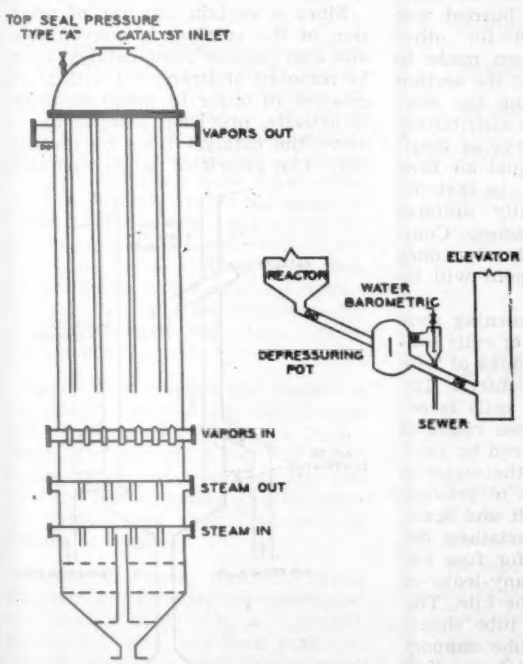


Fig. 5—T. C. C. reactor details

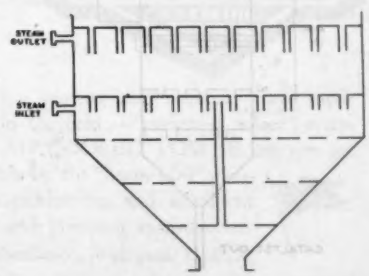


Fig. 7—T. C. C. reactor purge zone

corrosive stocks the reactor is lined with the proper alloy steel. This is accomplished with the minimum expenditure of expensive alloy. The elimination of heat insulation from within the reactor avoids the difficulty frequently encountered in this construction of coke formation within any porous material with subsequent uncontrollably high temperatures, in the event of air getting to the coke. This coke formation also tends to spall most refractories.

Kiln

The design of the kiln has evolved after many years of study of clay burning and is based on commercial experience with percolation clay regenerators. This work has been described by Simpson et al.[4] Numerous improvements and simplifications have been incorporated. The major of these changes is the elimination of angle packing and replacement of the salt cooling system with direct steam generating coils.

A sketch of a recent kiln is shown in Fig. 8. The distribution and control of flow of catalyst in the kiln is handled by the same designs as used in the reactor. The kiln is of square cross-section in order to facilitate the entrance of the cooling coils. It is lined inside with a suspended tile lining (Dietrich or Bigelow-Liptak). This construction has proved quite satisfactory, since the kiln operation is at substantially atmospheric pressure, and the extensive use of buck stays on the flat walls is not required.

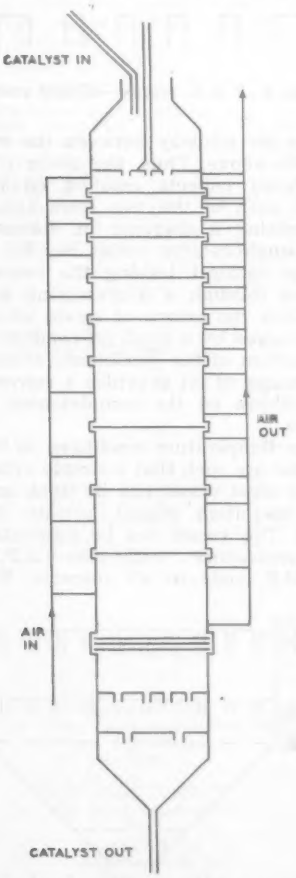


Fig. 8—T. C. C. kiln

No sealing of the top of the kiln is required, since the escaping flue gas from the top section is substantially oxygen-free.

The details of one zone in the kiln are shown in Fig. 9. One air inlet is used with two collectors. The minimum air path is about 30 in. which provides a pressure drop of a few inches of water through the catalyst. In the lower zones, longer holding time and longer air path are provided. The air-inlet duct extends across the kiln and the distributor channels extend from the duct to the wall. As in the case of the oil-inlet grid, of the reactor, the distributor channels are narrow and deep. Under normal flow conditions, there is a pressure change of 0.2 in. of water along the duct. While this pressure change is very small, it may be sufficient to affect slightly the air distribution, although perhaps not seriously if the absolute maximum burning efficiency is not required. In one of the latest commercial units where the coke to be burned was somewhat higher than for other units, an effort has been made to control the air flow over the section by inserting a pipe from the inlet duct to the center of the distributing channel. These pipes serve as limiting orifices, insuring equal air flow to each channel section; so that the air flow is substantially uniform over the entire cross-section. Comparison of this unit with other ones not having this refinement will be very interesting.

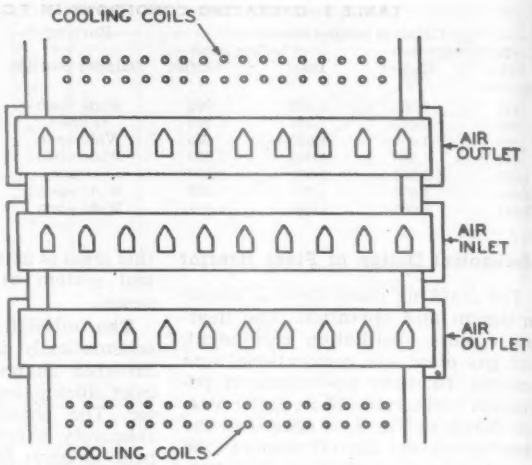


Fig. 9—T. C. C. kiln—typical burning and cooling zone

At the exit of each burning zone is located a cooling coil or coils consisting of one or more banks of 2-in. coils on about 5-in. centers. The flow of water to these coils is arranged so that only those required to control temperature need be used. When a coil is cut off, the water is flushed out with steam to prevent excessive deposits of salt and scale. The usual method of installing the cooling tubes provides for free expansion, but minimizes any leaks of air in or fumes out of the kiln. The tubes are supported by tube sheets at the end and by a tube support resting on a beam of heat resisting steel in the center. The tubes are rolled into the front tube sheet, and all outside connections of water and steam are made from this end. However, the tubes are not rolled into the rear tube sheet, but are free to expand. The return bends are in a box at the "rear" of the tubes, and this box is gas tight, so there is no gas leakage to the outside, in spite of the floating fit of the tubes through this tube sheet.

The air to the kiln is furnished by two vertical ducts, and the fumes are taken away by two other vertical ducts. The flow is controlled by dampers in the ducts. Since there are two separate air-inlet systems, it is possible to use one for hot and one for cold air, so that any combination which is desirable for proper control can be obtained.

Since a certain amount of attrition of the catalyst is unavoidable, and also because some catalyst must be removed and replaced with fresh catalyst in order to maintain proper activity, provision is made to remove the catalyst fines by elutriation. The elutriator is incorporated

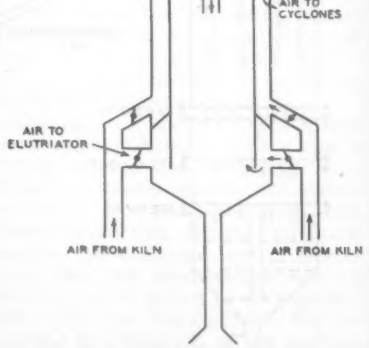


Fig. 10—T. C. C. elutriator

in the upper part of the kiln where a small stream of regenerated catalyst is diverted from the reactor feed to the elutriator. Spent regeneration fumes pass upward counter current to the catalyst. Using gas velocities in the order of 17 ft. per second, it has been possible to eliminate substantially completely all material finer than about 14 mesh. See Fig. 10.

Elevators

The elevators are one of the important key units of the plant, and much study has been given to their mechanical design. The links are of low-alloy steel and are designed to operate at temperatures up to 900° F.

The upper sprocket and head shafts are also designed for high-temperature operation. The teeth of the sprockets are hard surfaced for satisfactory service with a minimum of lubrication. Experiments using a light volatile oil containing about 30 per cent of fine graphite for lubrication of the sprocket teeth have shown that the oil is vaporized without residue, and the layer of graphite effectively lubricates the teeth and chain. The head shaft is hollow and is water cooled. As a further precaution that the shaft is insulated between the sprockets, the main bearings are water cooled and lubricated by forced oil feed.

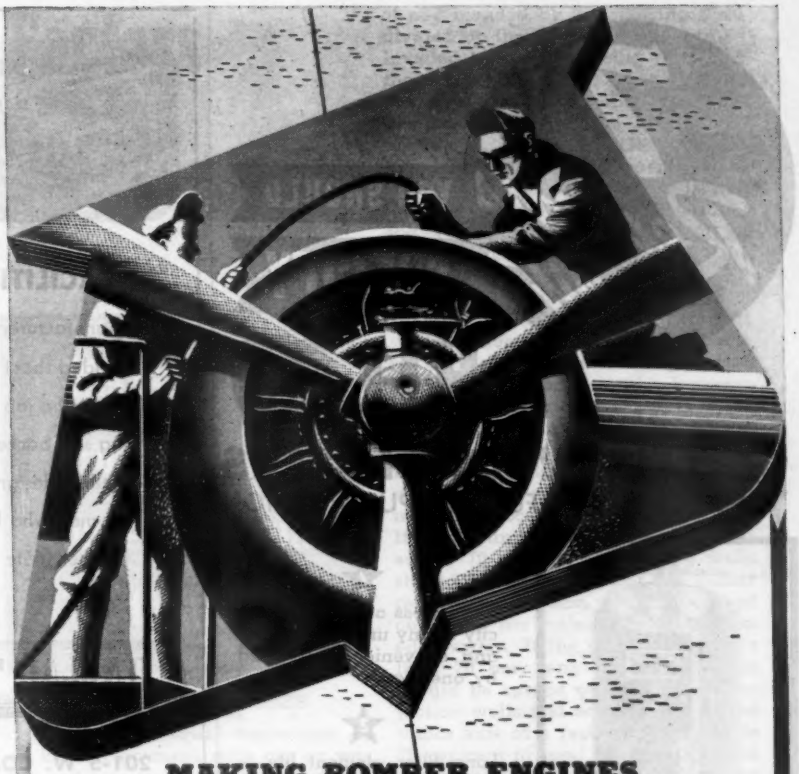
Literature Cited

1. Simpson, Evans, Hornberg and Payne, Refiner 22, 83 (1943).
2. Chilton and Colburn, Industrial and Engineering Chemistry, 23, 913 (1931).
3. Furnas, Bureau of Mines Bull., 307 (1929).
4. Simpson, Nicholls, and Payne Trans. A.I.Ch.E., 36, 841 (1940).

William H. Collins, who was chief of the petroleum equipment manufacturers' section of the division of materials, Petroleum Administration for War, has been appointed assistant director of the division of materials. He has been with PAW since October 1942 and takes the place of **David L. Trax,** who resigned in order to rejoin the staff of Gulf Oil Corp. in Tulsa. Collins, who was educated at University of Texas, was a district superintendent for Shell Petroleum Co., Inc., before joining PAW.

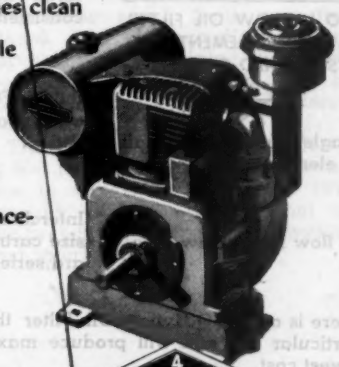
Harry W. Nankervis last week was appointed director of distribution and marketing for District 2, Petroleum Administration for War, with headquarters in Chicago. He had held the title of acting director since the retirement last October of **Ernest L. Hughes.**

Ernest J. Frueh, formerly acting director of supply and transportation for District 2, Petroleum Administration for War, has been made director. He is on leave from Shell Oil Co., Inc.



MAKING BOMBER ENGINES
"Come Clean"

To help keep huge bomber engines clean and free of dust and dirt, portable compressed air units are used—powered by these dependable *air-cooled* gasoline engines. One more vital war job for performance-proved Briggs & Stratton air-cooled gasoline engines.



Air-Cooled Power

4 CYCLE BRIGGS & STRATTON GASOLINE ENGINES

Their trouble-free performance, easy starting and economy have made Briggs & Stratton engines leaders in the field —"preferred power" everywhere. Only in Briggs & Stratton AIR-COOLED POWER can you get the superior performance made possible by the "know-how" gained through 25 years of continuous production, and consistent leadership in design, engineering, and precision manufacture.

BRIGGS & STRATTON CORP, Milwaukee 1, Wisconsin, U. S. A.

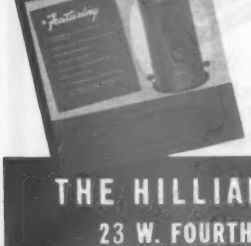
7 Reasons why- YOU SHOULD SPECIFY HILCO

HYFLOW OIL FILTERS
FOR LUBE AND FUEL OIL PURIFICATION

HILCO HYFLOW OIL FILTER
SINGLE ELEMENT
"STANDARD SERIES"

1. Regardless of size or capacity of any unit it is readily and conveniently serviced by one man.
2. Long filter element life — Hilite for mineral oils — Hiltex for heavy duty oils.
3. Complete utilization of a large filtering area with consistent depth.
4. Bulk or Factory filled throw-away cartridges at user's option.
5. Interchangeability of one size cartridge for all "standard series."
6. A single casing with small filter elements.
7. High flow rate at low pressure.

There is a HILCO Hyflow Oil Filter that will fit your particular job and will produce maximum results at lowest cost.



★ WRITE TO-DAY!

Request Bulletin HF for information on the HILCO Hyflow Oil Filter; Bulletin 95 on the HILCO Oil Reclaimer; Bulletin A-102 on the HILCO Airline Oil Purifier.

OUR ENGINEERING STAFF IS YOUR CONSULTANT

THE HILLIARD CORPORATION
23 W. FOURTH ST. ELMIRA, N. Y.

FACILITIES TO DO THE JOB!

Manufacturers and fabricators of all types of welded sheet and steel plate products. Facilities to do the job whether large or small. Engineering skill backed by constant research. All equipment is designed, manufactured and supervised by men who have had many years experience in steel plate construction.

TANKS BY DALLAS
DALLAS TANK Company, Inc.

201-5 W. COMMERCE ST., P.O. BOX 5387
DALLAS, TEXAS

WOOD RIVER

QUALITY PRODUCTS AVAILABLE TO THE INDEPENDENT JOBBER

ETHYL and all grades of leaded and unleaded gasoline
TRACTOR FUEL DIESEL FUEL
ASPHALT KEROSENE
Numbers 1, 2, 3, DOMESTIC FUEL OIL
RANGE OIL INDUSTRIAL FUEL OIL

SALES OFFICES:
HARTFORD, ILLINOIS P. O. Box 145
Phone Wood River 4-4374
ST. PAUL, MINNESOTA 1700 Stewart Avenue
Phone De Soto 5533

HOME OFFICE:
WICHITA, KANSAS

WOOD RIVER OIL AND REFINING COMPANY, INC.

Invasion Factors And Patterns

*by Park J. Jones**

Mechanics of Producing Oil, Condensate, and Natural Gas

PART 30 IN A SERIES

Other things equal, recoveries of oil by displacement with gas or water and recoveries of condensate by displacement with gas are proportional to invasion factors. An invasion factor is equal to the acre-feet of pay invaded by a displacing fluid divided by the acre-feet of pay to be invaded by the displacing fluid. As the sizes and shapes of reservoirs are already fixed, wells should be located relative to the distribution of pay in reservoirs. Other things equal, invasion factors depend on the location of producing and injection wells or on the location of producing wells relative to edge water.

In this concluding article of the series, one-well invasion factors and patterns are illustrated by contours. Invasion factors for any number of wells uniformly spaced on a circle are derived and illustrated by graphs. The contours for two-well invasion factors indicate that all points within reservoirs having a minor axis equal to, or less than, 70 per cent of the major axis length can be invaded by injecting a displacing fluid into wells located on the major axis. If the minor axis of a reservoir equals 70 per cent, producing wells should be grouped about the center relative to injection wells but spread out along the major axis relative to edge water. If the minor axis is less than 70 per cent, producing wells should be spread out relative to injection wells and edge water. If the minor axis of a reservoir is equal to 70 per cent or less, locating injection wells at points other than on the major axis will cause displacing fluid to finger into producing wells prematurely.

This is the final installment of the series on Mechanics of Producing Oil, Condensate, and Natural Gas. The series began in the issue of November 4, 1944, and an installment has appeared in each succeeding issue, with one exception.

The One-Well Invasion Pattern

CONSIDER the displacement of a reservoir fluid by an injected fluid in a pay of uniform thickness and permeability. Let the viscosity, effective permeability, and volume factor ratios for the two fluids be the same. Under these conditions, the region invaded by the displacing fluid will have the successive contours shown in Fig. 30-1. The producing and injection wells are far from other producing and injection wells and from impermeable structural and stratigraphic boundaries. The effect of gravity is neglected. The contour which fingers into the producing well is called the breakthrough contour. The time at which a displacing fluid first appears in a producing well is called the breakthrough time.

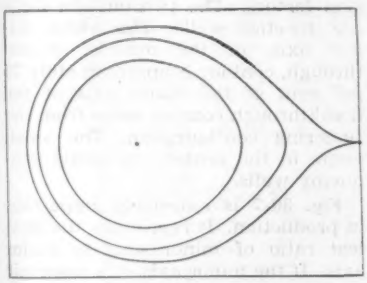


Fig. 30-1—One-well invasion patterns and invasion factors. Data by Muskat

The area within any one of the three contours shown in Fig. 30-1 divided by the area to be invaded is called the invasion factor. For example, if the area to be invaded is the area bounded by the straight lines, the breakthrough invasion factor is equal to the area within the breakthrough contour divided by the area within the straight lines.

If an injection well is located in the center, the contours represent invasion patterns. But if a producing well is located in the center, the contours represent invasion factors. Invasion factors and invasion patterns for one injection well can be represented by one set of contours. If there is more than one injection well, two sets of contours are required; one set to map out invasion patterns and another to map out invasion factors.

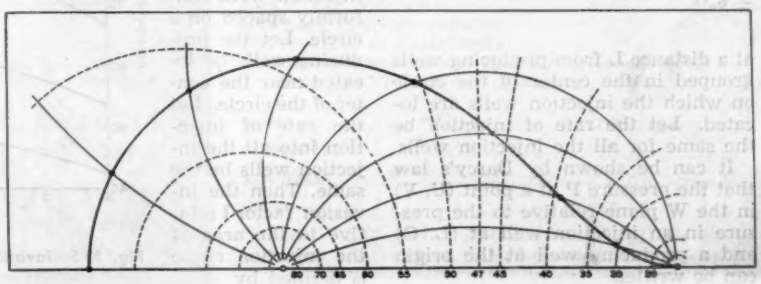
Pressure Cruves, Displacement Lines

Fig. 30-2 shows one-half of the breakthrough pattern of the preceding figure. The dashed curves represent pressure expressed in per cent of the pressure at the injection well. The solid curves represent the lines along which fluids are displaced. The shortest displacement curve is the line joining the injection and producing wells. This is called the breakthrough displacement line.

The rate of advancement $\Delta X/\Delta t$ in feet per day along a displacement line in any interval between two pressure curves is proportional to the pressure gradient $\Delta P/\Delta X$ within that interval, that is

$$\frac{\Delta X}{\Delta t} = C\frac{\Delta P}{\Delta X} \qquad (1)$$

Fig. 30-2—Illustrating pressure distribution, dashed curves, displacement lines, solid curves; and position of interface at the time of breakthrough, heavy curve. At the time of breakthrough an injected fluid advanced along the displacement lines up to the points. The heavy curve through these points is one-half of the breakthrough patterns. The numbers are per cent pressure drop between the injection and producing wells



*Production consultant, Houston.

where C is a constant. The time required to advance from one pressure curve to another along a displacement line is defined by

$$\Delta t = \frac{1}{C}\frac{(\Delta X)^2}{\Delta P} \qquad (2)$$

Hence, the breakthrough time t_B is defined by

$$t_B = \frac{1}{C}\sum_{X=O}^{X=D}\frac{(\Delta X)^2}{\Delta P} \qquad (3)$$

where D is the distance between injection and producing wells.

Along displacement lines other than the breakthrough line, the injected fluid has advanced up to the point for which

$$\Sigma\, \Delta t_L = t_B \qquad (4)$$

where Δt_L is the time required to advance from one pressure curve to another along any displacement line L. A curve through the points on the displacement lines at breakthrough time gives one-half of the breakthrough contour.

The W Plane

Next consider N injection wells uniformly spaced on a circle. For example, let N = 6 as shown in Fig. 30-3. The injection wells are located

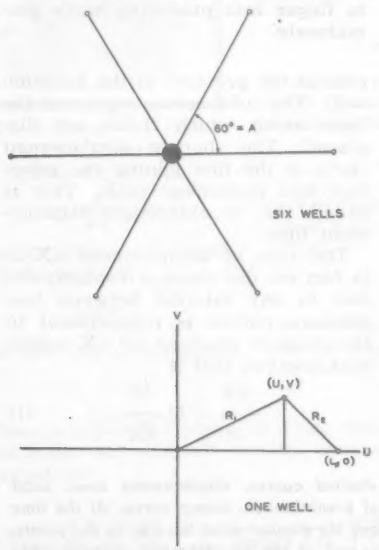


Fig. 30-3—The W plane, $W = U + iV = Re^{iA}$

at a distance L from producing wells grouped in the center of the circle on which the injection wells are located. Let the rate of injection be the same for all the injection wells.

It can be shown by Darcy's law that the pressure P at a point (U, V) in the W plane relative to the pressure in an injection well at (L, O) and a producing well at the origin can be written

$$P = C\,[\log R_1 - \log R_2] \qquad (5)$$

where C is a constant. At the point (U, V)

$$R_1 = \sqrt{U^2 + V^2}$$

$$R_2 = \sqrt{(L - U)^2 + V^2}$$

Along the line V = O,

$R_1 = U$

$R_2 = L - U$

$$P = C\,[\log U - \log (L - U)] \qquad (6)$$

The Z plane

If we let

$$W = Re^{iA} = Z^N = r^N e^{iNa} \qquad (7)$$

reference to a textbook on conformal mapping will show that N producing wells about the origin in a W plane transform into one producing well at the origin in the Z plane. And that N injection wells in the W plane transform into one injection well in the Z plane. Thus, the six wells in the W plane of Fig. 30-3 transform into one well in the Z plane of Fig. 30-4. Equation 7 is used to derive

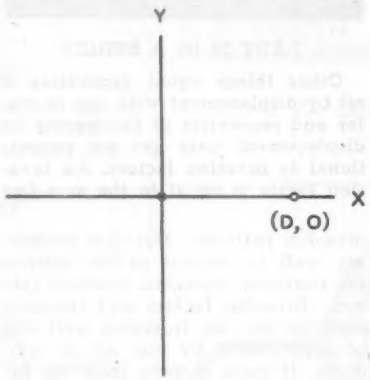


Fig. 30-4—The Z plane, $Z = X + iY = re^{iA}$

invasion factors for N injection wells located on a circle. Producing wells are grouped about the center of the injection circle.

Invasion Factors for N Wells on a Circle

Invasion factors for N injection wells are derived in the appendix to this article. Consider N injection wells uniformly spaced on a circle. Let the producing wells be located near the center of the circle. Let the rate of injection into all the injection wells be the same. Then the invasion factor I relative to the area of the injection circle is defined by

$$I = \left(\frac{N}{N+Z}\right)\left(\frac{D}{R}\right)^N \qquad (8)$$

where

N = number of injection wells

D = distance between the producing and injection wells

R = radius of a circular productive area $R \geqq D$

If the radius of a circular productive area is less than the radius of an injection circle, the corresponding invasion factor is defined by

$$I = 1 - \left(\frac{Z}{N+Z}\right)\left(\frac{R}{D}\right)^N \qquad (9)$$

Equation 9 is for a circular productive area concentric with an injection circle. Equations 8 and 9 are based on the work of Muskat[2] and Hurst and McCarthy[3]. Dr. A. Wolf applied the method shown in the appendix in deriving them. Solutions of Equations 8 and 9 are shown by the curves in Figs. 30-5 and 30-6.

Two-Well Invasion Factors

If one-well contours like those in Fig. 30-1 are mapped out 180° apart, the result is similar to that illustrated in Fig. 30-7. The contours in this figure represent two-well invasion factors. The two outside wells are injection wells. The width, minor axis, of the outside, breakthrough, contour is approximately 70 per cent of the major axis of the breakthrough contour aside from the fingering configuration. The small circle in the center represents producing wells.

Fig. 30-7 is extremely important in production. It represents the critical ratio of minor axis to major axis. If the minor axis of a reservoir is 70 per cent of the major axis length, only two injection wells are required to invade all points within the reservoir. The injection wells are located on the major axis. The

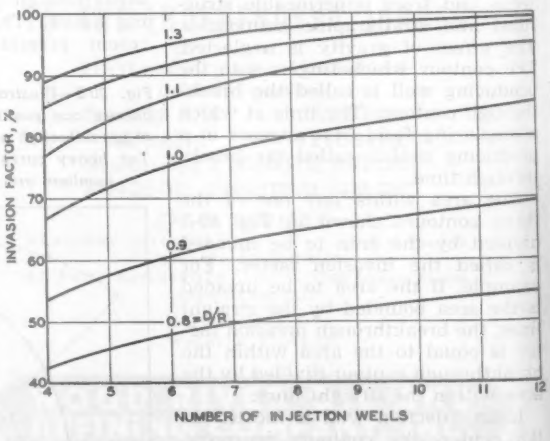


Fig. 30-5—Invasion factors vs. number of wells and location of wells

VITALLY IMPORTANT FOR EVERY DRILLING PROGRAM

INCREASES PRODUCTION—SAVES CASING—ASSURES BETTER CEMENT JOBS

Grant 2-BLADE HYDRAULIC EXPANSION WALL SCRAPER

The GRANT Wall Scraper is a many-purpose tool, vitally important for every drilling program. It is used to enlarge the hole in the area of the exposed producing sand, and to enlarge the hole in SOFT formations to permit running larger casing. To secure a better cement job, it is used to enlarge the hole above the setting point of the shoe, thus assuring a thick body of cement around the casing which will not be disturbed in following drilling operations. When placing a cement plug, the Wall Scraper enlarges the hole at the point where the plug is to be set, thus exposing the formation which creates a better bond for the cement. Also Gravel Packing, Water Shut-Off Tests and Cutting Out operations on drillable pipe are performed more effectively with the GRANT Wall Scraper.

INCREASED SAVINGS WITH THE GRANT CIRCULATION CONTROL HEAD

The Circulation Control Head used in the GRANT Wall Scraper reduces to a minimum the abrasive action of sand or other foreign materials. This head utilized the principle of streamlined flow, and directs the streams of fluid against each other within the head, thus nullifying the force of the fluid which might otherwise cut out expensive steel parts

The Circulation Control head is easily changed to suit any condition—large slots for big pumps—small slots for small pumps. The Control Head will last for years.

For hard formation use the Grant New Underreamer Model 8447—Mail Coupon below for complete information on all GRANT Tools

USED WHERE PERFORMANCE COUNTS

GRANT OIL TOOL CO.
2042 EAST VERNON AVENUE
LOS ANGELES 11, CALIFORNIA

Branches: AVENEL, BAKERSFIELD, SANTA MARIA
VENTURA, CALIFORNIA • ODESSA, TEXAS

GRANT OIL TOOL CO.
2042 EAST VERNON AVENUE,
LOS ANGELES 11, CALIFORNIA.

Please send me, without obligation, complete information on the GRANT Tools checked below.

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... STATE.....

☐ Bailers ☐ Gleaners ☐ Hole Enlargers ☐ Liner Pullers
☐ Reamers ☐ Shale Bits ☐ Underreamers ☐ Wall Scrapers
☐ Safety Automatic Pressure Releases (Mud Pumps)

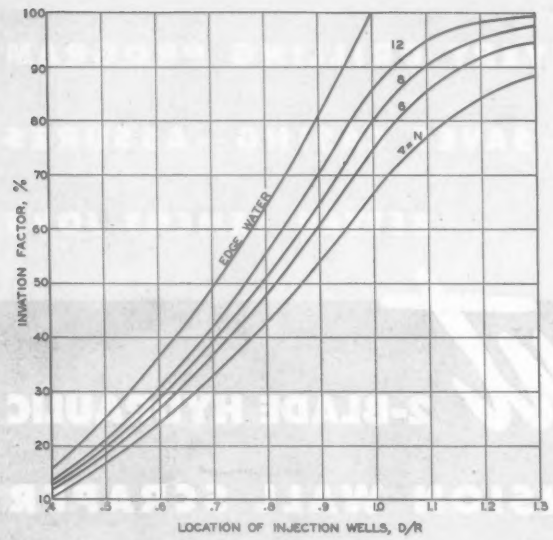


Fig. 30-6—(Left) Invasion factors vs. location of wells and number of wells

Fig. 30-7—(Above) Two-well invasion factors: acre-feet of pay invaded within the breakthrough contour to acre-feet of pay in reservoir equals breakthrough invasion factor; minor axis is 70 per cent of major

producing wells are grouped in the center. If an injection well were located elsewhere than on the major axis, displacing fluid would finger into producing wells before invading all points in the reservoir. If the reservoir were bounded by edge water, each point on the perimeter would, in effect, be an injection well. Hence, producing wells have to be spread out along the major axis in order to prevent fingering in of edge water along the minor axis.

Four-Well Invasion Factors

If one-well contours like those in Fig. 30-1 are mapped out 90° apart, the result is similar to that illustrated by Fig. 30-8. The contours in this figure represent four-well invasion factors. The four outside wells are injection wells. The small circle represents centrally located producing wells.

If one-well contours are mapped out 60° and 45° apart, the results would represent six-well and eight-well invasion factors respectively. In practice this mapping need not be done. The curves in Figs. 30-5 and 30-6 give the invasion factor for N wells on an injection circle. Hence, the invasion factor relative to a reservoir is equal to the invasion factor for an injection circle divided by the area of a reservoir. If the pay thickness is not uniform, the areal invasion factors should be corrected for variation in pay thickness to obtain invasion factors relative to acre-feet of pay. There is also a correction to be applied for differences in viscosity, relative permeability, and volume factors between the displacing and displaced fluids.

Invasion Factors for Elongated Reservoirs

Fig. 30-9 represents invasion factors for a reservoir having a minor axis equal to about 35 per cent of the major axis length. The two outside circles represent several injection wells located on the major axis at, and beyond, the productive limits. The inside wells along the major axis are producing wells. If injection, or producing wells are not located on the major axis, displacing fluid will finger in before all the points in the reservoir are invaded. If the producing wells are not spread out, displacing fluid will be pulled in along the minor axis before all the points in the reservoir are invaded. If there are no injection wells but the reservoir is bounded by edge water, the producing wells should be spread out along the major even more than shown in the figure. Otherwise, edge water would be pulled in along the minor axis before it would reach the end producing wells along the major axis.

References

1. Hurst and McCarthy, A.P.I., 1941.
2. Muskat, M., "Flow of Homogeneous Fluids," McGraw-Hill Book Co.

Appendix to Part 30

In the W plane along the line V = O,

$$\frac{dU}{dt} = \frac{\partial P}{\partial U} = C\left[\frac{\partial}{\partial U}\log U - \frac{\partial}{\partial U}\log (L - U)\right]$$

$$= C\left[\frac{1}{U} + \frac{1}{L-U}\right] = \frac{CL}{U(L-U)}$$

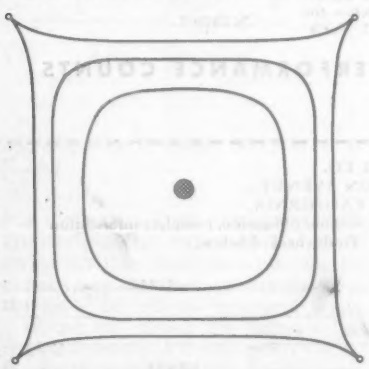


Fig. 30-8—Four-well invasion factors: acre-feet invaded within the breakthrough contour to acre-feet in reservoir equals the breakthrough invasion factor

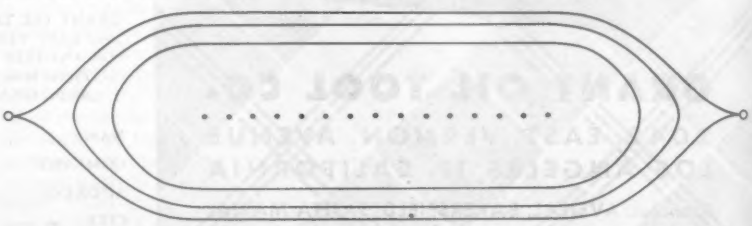
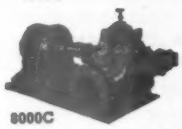


Fig. 30-9—Two-well invasion factors: acre-feet invaded within the breakthrough contour to acre-feet in reservoir equals the breakthrough invasion factor; the minor axis is about 35 per cent of the major axis

PUMPS
CENTRIFUGAL
RECIPROCATING



ESTABLISHED 1869

DEAN BROTHERS PUMPS INC.

INDIANAPOLIS IND.

323 W TENTH ST.

LIGHT AND POWER
FOR CONTINUOUS OPERATION
DIESEL-ELECTRIC **POWR-PAK**

Low cost, reliable operation—over a century of experience behind Lister-Blackstone engines! Compact, ready to be put to work... lighting drilling rigs, etc.—sizes, 3½ to 10 kw. Also Diesel engines for powering gathering pumps and small well pumps — 8 and 16 h. p.

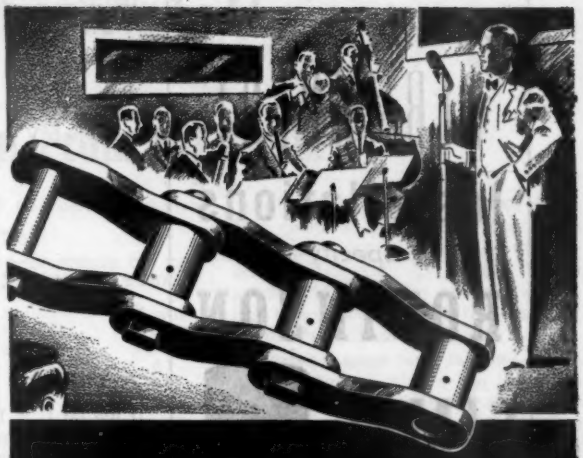
Auxiliary units also available.

LIGHT AND POWER
FOR NIGHT REPAIRS
THE NITE-HAWK

Portable, engine-driven power plant for night repairs in isolated areas. Four 80,000 candle power floodlights, adjustable up and down and in all directions! Also, power to operate electric hand tools!

Powr-Paks and Nite-Hawks are available through oil field supply stores everywhere. Literature on request.

LISTER-BLACKSTONE, Inc.
1706 SOUTH 68th ST. • MILWAUKEE 14, WISCONSIN



Take Part In Our Chain Program

☆ It may be possible for you to be our star. For our Chain Program is a campaign to acquaint more Oil Field Chain buyers with Union Chains and the stars of such a program are, of course, our new customers.

So if you haven't used Union Oil Field Chains, call us in on your next requirement. Our confidence is based on our reputation as chain specialists, earned because we confine ourselves to the manufacture of a complete line of steel chains, sprockets and flexible couplings. Then, too, we do all we can to be sure that our chain is used properly and that adds years of life. Whose life? Why the life of the chain and yours, too.

The Union Chain and Manufacturing Company
Sandusky, Ohio, U. S. A.

Union Oil Field Chain for Every Application

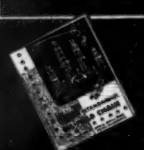
A. P. I. No. 3½ P Union *Superintendent* No. 3125-R
A. P. I. No. 3½ P Union *Superintendent* No. D-3125-R
A. P. I. No. 4 P Union *Jumbo* No. 1240-SXX
A. P. I. No. 4 P Union *Toolpusher* No. 1240-RXX
A. P. I. No. 4 P Union *Driller* No. 1240-R 4
A. P. I. No. 4 C Union *Roughneck* No. 1240-RX
A. P. I. No. 3 P Union *Toolpusher* No. 1190-RXX
A. P. I. No. 3 P Union *Driller* No. 1190-R 3
A. P. I. No. 3 C Union *Roughneck* No. 1190-RXS

★

Finished Steel Roller Chains and Sprockets
All manufacturer's standard sizes ⅜ in. to 2½ in. pitch in single and multiple strands.

Flexible Couplings
Roller Chain type
Silent Chain type

Oil Field Chain Export Sales
E. F. GAHAN
500 Fifth Ave., New York 18, N. Y.



Union Bulletin O-1 covers Oil Field Chain. Ask for your copy.

UNION CHAINS

for —

PERMANENT

Installations

specify

ROBINSON

LIMIT PLUGS

The superiority of Robinson products is reflected in our LIMIT PLUG — built with ample water courses to withstand high pressures — and constructed to accommodate large expansions . . . plus these features:

- **Cypress wood construction**
- **Cast-iron guide weight**
- **Uniform pressure packs and solidifies sidewall**

P. O. Box 1408

TULSA, OKLAHOMA

Factory: Coffeyville, Kansas

In the Z plane along the line $y = O$,

$$\frac{\partial P}{\partial X} = \frac{\partial P}{\partial U} \cdot \frac{\partial U}{\partial X}$$

but when $V = O$ and $y = O$

$$U = X^N$$

and

$$\frac{\partial U}{\partial X} = NX^{N-1}$$

so

$$\frac{\partial P}{\partial X} = \frac{CNLX^{N-1}}{U(L - U)}$$

If we let $L = D^N$

$$\frac{\partial P}{\partial X} = \frac{CND^N}{X(D^N - X^N)}$$

As the breakthrough time is given by

$$t_B = \int_O^D \frac{dX}{\frac{\partial P}{\partial X}} = \frac{1}{CND^N} \int_O^D \times (D^N - X^N)\, dX$$

$$t_B = \frac{1}{CND^N} \left[\frac{D^N X^2}{Z} - \frac{X^{N+2}}{N+2}\right]_O^D$$

$$t_B = \frac{D^2}{2C(N+2)}$$

As the area invaded by an injection fluid is proportional to time and as there are N injection wells

$$A = C^1 \frac{N}{N+2} D^2$$

If every point on the injection circle were an injection well the area invaded would equal πD^2 and $N/(N+2)$ for $N \to \infty$ is one, accordingly $C^1 = 3.14$ and the invaded area A_D is given by

$$A_D = \frac{3.14\, ND^2}{N+2}$$

where A_D is the area invaded within an injection circle of radius D.

If the injection circle extends beyond the productive limits of a circular field, the invaded area A_B for the productive limits of a circular field is obtained as follows:

$$t_B = \frac{1}{CND^N} \left[\frac{D^N X^2}{2} - \frac{X^{N+2}}{N+2}\right]_O^R$$

$$= \frac{R^2}{2NC} \left[1 - \frac{2}{N+2} \left(\frac{R}{D}\right)^N\right]$$

so

$$A_B = 3.14\, R^2 \left[1 - \frac{2}{N+2} \left(\frac{R}{D}\right)^N\right]$$

where A_B is the area invaded within a productive circle of radius R. The productive circle is concentric with the injection circle.

BOOKS

PRODUCTION LINE TECHNIQUE, by Richard Muther. Published by McGraw-Hill Book Co., Inc., New York. 320 pp., $3.50.

From first-hand field investigations of current practices in manufacturing plants, the author, member of Department of Business and Engineering Administration at Massachusetts Institute of Technology, divides the subject into four parts: (1) Line Production—Its Advantages and Limitations; (2) Establishing the Line; (3) Operating the Line; (4) Diversification in Line Production.

While the book is concerned principally with production-line practices as exemplified by the Detroit manufacturing area, features of the different techniques discussed will be of interest to engineers engaged in various phases of the petroleum industry. Although oil-well drilling, production, pipe-line transportation, and particularly petroleum refining, have gradually built up, over a number of years, certain production-line practices of their own simply by the hard route of experience, this dissection of America's manufacturing "know how" on mass technology should give the petroleum engineer some new slants and ideas for his own work. There are 113 figures devoted to assembly lines and various flow assemblies. At the end of the book are given 18 problems in the nature of setups of tools, materials and products for hypothetical companies, and the reader is given an opportunity to work out the best procedure for manufacturing the items by some production-line method.

WARTIME TECHNOLOGICAL DEVELOPMENTS. A study made for the Subcommittee on War Mobilization of the Committee on Military Affairs, United States Senate. 418 pp.

This report is a valuable aid to understanding America's postwar economic opportunities. It covers a large number of wartime technological developments, described and evaluated by the Bureau of Labor Statistics of the United States Department of Labor. It is limited to published information, and it does not include important wartime developments which remain secret at this time for reasons of national security. It is, however, the first effort to compile and digest information already released on hundreds of scientific achievements, and it is a useful survey for Congress and for public and private agencies and persons engaged in formulating postwar programs.

This study is one of a number initiated by the subcommittee to explore the problems involved in assimilating and more fully utilizing wartime scientific and technical achievements, and to assist the Congress in formulating policies for the furtherance of this objective.

Engineering Fundamentals

No. 188

A FEATURE OF THE OIL AND GAS JOURNAL

Measuring Water Production From Oil Wells

Methods of measuring water.—Amount of water produced with oil is important to the operator in following the rate and extent of water incursion into an oil reservoir, in determining which wells need to be repaired, and which ones are uneconomical to operate and should be abandoned. The method selected to determine water volumes and water ratios depends upon the amount of water, accuracy needed, and use for which the figures are intended. The most common methods are centrifuge method, distillation method, portable gage tank method, extra flow tank method, and glass cylinder method.

Hand centrifuge method.[1]—If only small quantities of water are present, and especially if the droplets of water are in suspension or intimately mixed with the oil, the centrifuge method is applied. An ordinary crank or electric-motor-driven centrifuge may be used with finger-type glass tubes holding 12.45 ml. of fluid and graduated into divisions showing per cent by volume. All the tubes in the centrifuge are filled to the 50 per cent mark with benzol and then to the 100 per cent mark with the oil-water mixture to be tested. The tubes are placed in the centrifuge and rotated at 1,500 r.p.m. for 10 minutes. The tubes are removed and the volume of water, sediment, and oil read directly from the volumetric graduations on the sides of the tubes. To check the results, the tubes may be replaced in the centrifuge and revolved again for 5 minutes. If there is no change, the readings are recorded. If the results differ more than 0.2 per cent, the revolutions should be repeated for another 5 minutes. if the weather is cold and much paraffin occurs in the oil, it may be advisable to heat the tubes in a dish of warm water to 120° F. before centrifuging.

The accuracy of the method depends upon the care in rotating, in reading the liquid levels, and the size of the graduations on the tube, It is important to hold the liquid interface to be read directly opposite the eye and to place white paper in back of the tube. Limits of error according to the American Petroleum Institute range from 0.1 to 0.5 per cent as shown in Table 1.

TABLE 1—LIMITS OF ERROR ON FINGER-TYPE CENTRIFUGE TUBE

Range per cent	Scale divisions per cent	Limit of error per cent
0-3	0.2	0.1
3-10	0.5	0.2
10-50	1.0	0.5

Distillation method.[2]—This method is considered to be the most accurate and is used to check other methods where extreme accuracy is desired. It also is used where the water droplets in the oil are so small that they will not separate out in the centrifuge easily. The apparatus consists of a 500-ml., round-bottomed, short-necked flask connected to a side-necked, graduated tube carrying at the top a reflux condenser (Fig. 1). One hundred millimeters of the liquid to be tested are placed in the flask and heated with a Bunsen burner to a temperature so regulated that water distilled in the condenser drips into the graduated receiver at the rate of 2 to 5 drops per second. The distillation is continued until all of the water in the oil has been distilled off and caught in the graduated receiver. The receiver is removed from the condenser and the amount of water read directly by means of the graduated divisions on the receiving tube. Accuracy of this method should be within 0.1 ml.

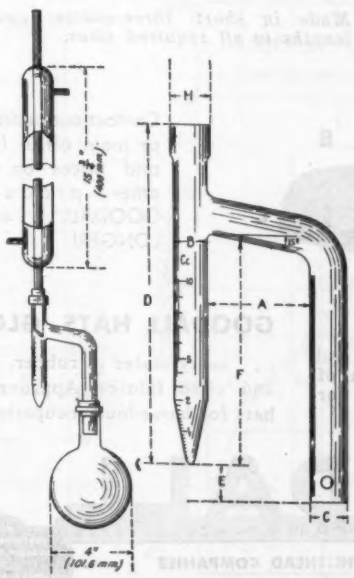


Fig. 1—Sketch illustrating method of determining amount of water in oil by distillation

Portable gage tank method.—The tests described above are intended for oil containing less than 10 per cent water. If the oil contains larger quantities of water, most of which settles out, then other methods of measuring the water are used. Where there are a number of wells connected with a single tank battery and the production per well is relatively small, many operators use a portable gage tank or tanks mounted on a trailer, and equipped with an oil pump for pumping the oil into the tank battery when the test is finished. The tanks vary in size according to the size of the wells to be tested. The tanks are strapped and gage tables prepared in exactly the same manner as for a large tank. At the well, connection is made with the flow line and the valve opened. At the same instant, time is noted by a stop watch. Fluids from the well are allowed to flow or are pumped into the tank until it is nearly filled. The time is noted again. The fluid is measured with a gage stick, and the line of oil-water interface on the gage stick noted accurately. This is accomplished by attaching a strip of absorbent paper, impregnated with a solution of cobalt chloride, to the gage stick. Cobalt chloride paper, known as thieving paper, has a light yellow color and can be purchased from chemical-supply houses. The gage stick, to which the paper is attached, is lowered carefully to the bottom of the tank and withdrawn in such a way that the oil is not agitated. Position of the oil-water contact is indicated sharply by a change in color from yellow to blue of that portion of the paper which came in contact with the salt water.

References

1. Code for Measuring, Sampling, and Testing Crude Oil: A.P.I. Code No. 25 (A.S.T.M. Method D-96), pp. 22-23, January 1936.

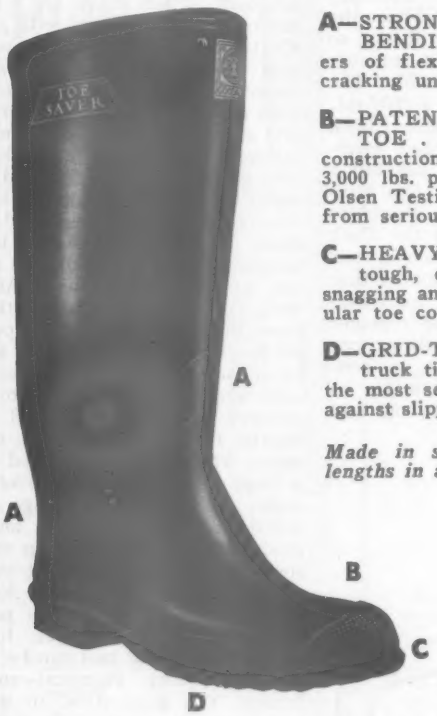
2. Standard Method of Test for Water in Petroleum Products and Other Bituminous Materials: A.S.T.M Com. Rept. D-2, pp. 182-185, 1930.

Series prepared by F. B. Plummer, professor, petroleum engineering school, University of Texas

"INDUSTRIAL *Toe-Saver"* . . . . .

A *BETTER* BOOT, FOUR WAYS!

One of the most popular boots in the Goodall line . . . favored by workers in every industry for its demonstrated quality and comfort. In addition to the sound construction and careful workmanship that makes it a *good* boot, from top to toe, the "Industrial Toe-Saver" has four features that guarantee *extra* value.



A—STRONG REINFORCEMENTS AT BENDING POINTS . . . additional layers of flexible rubber that guard against cracking under continuous movement.

B—PATENTED STEEL BOX SAFETY TOE . . . securely built into the toe-construction, and guaranteed to withstand 3,000 lbs. pressure per square inch on the Olsen Testing Machine. Positive protection from serious toe injuries.

C—HEAVY BUMPER TOE TIP . . . a tough, extra wear patch that prevents snagging and consequent damage to the regular toe covering.

D—GRID-TREAD SOLES . . . built like a truck tire to give maximum wear under the most severe conditions, and for defense against slipping on wet or oily surfaces.

Made in short, three-quarter and full-hip lengths in all required sizes.

Contact our nearest branch or main office for details and prices on this and other products by GOODALL . . . on the Job LONGER!

GOODALL CLOTHING

. . . all kinds of rubber, synthetic and oiled clothing for the protection of workers in every industry. Send for Catalog.

GOODALL HATS, GLOVES

. . . many styles in rubber, synthetic and oiled fabrics. Approved safety hats for hazardous occupation.

GOODALL

GOODALL RUBBER CO. INC.

THE GOODALL-WHITEHEAD COMPANIES

Philadelphia • Trenton • New York • Chicago
Pittsburgh • Boston

WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

GOODALL RUBBER CO. OF CALIF.
Factory — Trenton, N. J.

GOODALL RUBBER CO. OF TEXAS
Established 1870

Souvenir of the Battle of Production

MANY a "T" hat will be cherished as a souvenir of World War II's battle of production. The McDonald "T" hat is the war worker's proudest badge of patriotism. No wonder so many employees want to buy their own "T" hats — for protection now, and for a souvenir after Victory. "T" hats are available now and may be issued or sold to workers in essential industries.

B. F. McDONALD CO.

Manufacturers & Distributors of Industrial Safety Equipment

Safety FROM HEAD TO FOOT

5104 SOUTH HOOVER STREET
LOS ANGELES 37, CALIFORNIA

Other Offices
in San Francisco & Houston

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

A.S.T.M. and T.B.P. Curves

THE common A.S.T.M. distillation is exceedingly useful because it can be obtained in 30 minutes or less time but it does not describe the real distribution of hydrocarbons that compose the material. For this reason the physical properties, such as boiling point, gravity, flash-point, etc. which are needed for design work cannot be estimated from the A.S.T.M. distillation curve. In order to estimate these physical properties correctly, it is necessary to have a true-boiling-point distillation curve of the material, a curve that shows the true distribution of hydrocarbons in the order of their boiling points. Such curves can be obtained in the laboratory but they requre so much time and expense that they are more frequently obtained by a correlation such as that shown on this page in Fig. 1. Only in the middle boiling-range (around 50 per cent) does the A.S.T.M. distillation curve indicate the real or true boiling-range of the material.

Fig. 2 shows the A.S.T.M. curves of the aviation gasoline, motor naphtha, kerosene and diesel (or distillate) fuel oil of the products evaluated in The Refiner's Notebook No. 31 (Feb. 24, 1945). They are superimposed on the true boiling point curve of the crude oil from which they are derived. The A.S.T.M. curves were computed from the true boiling point curve by means of Fig. 1.

Example.—The Refiner's Notebook No. 31 shows 16 per cent of motor naphtha which has an end-point of 415° F. and extends between 13 and 29 per cent in the crude oil. According to Fig. 1 the A.S.T.M. temperatures corresponding to the known true boiling point temperatures are:

	T.B.P.	A.S.T.M.
99 per cent	412	399
90 per cent	402	388
80 per cent	386	...
50 per cent	339	339
20 per cent	292	...

The slope of the T.B.P. curve of the motor naphtha is:

$$\frac{386 - 292}{60} = 1.58°/\%$$

By Fig. 1 the A.S.T.M. slope is 1.1, and two other temperatures are:

A.S.T.M. 70% pt.
$= 339 + (70 - 50)\ 1.1 = 361°$ F.

A.S.T.M. 20% pt.
$= 339 + (20 - 50)\ 1.1 = 306°$ F.

These two temperatures are 24.2 per cent and 16.2 per cent respectively based on crude oil (Fig. 2).

Serious errors occur unless the true boiling point curves of the products are used. Thus, according to the A.S.T.M. curve of the (raw) aviation gasoline, it would seem to have a vapor pressure under 3 lb. whereas actually its vapor pressure exceeds 8 lb. Likewise, the flash points of the kerosene and distillate would seem by the A.S.T.M. curves to be adequately high whereas they are very low. In making design calculations the misleading A.S.T.M. distillation curves are particularly troublesome and confusing.

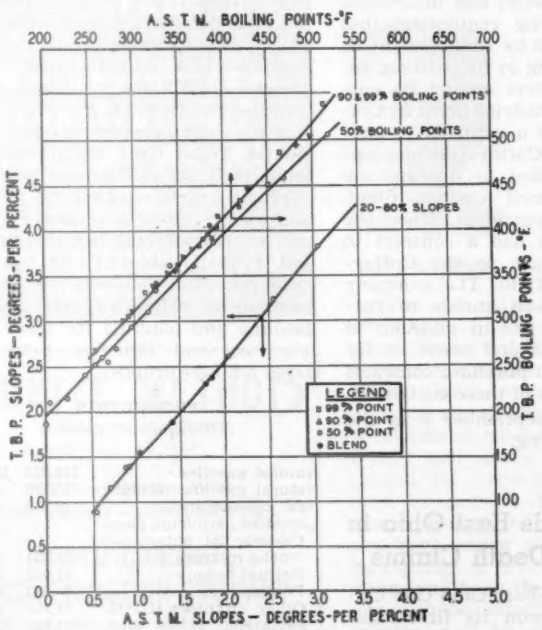

A. S. T. M. BOILING POINTS-°F
200 250 300 350 400 450 500 550 600 650 700
90 & 99 % BOILING POINTS
50% BOILING POINTS
20-80% SLOPES
LEGEND
99 % POINT
90 % POINT
50 % POINT
BLEND
T. B. P. SLOPES—DEGREES-PER PERCENT
T. B. P. BOILING POINTS - °F.
A. S. T. M. SLOPES—DEGREES-PER PERCENT
0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5
100 150 200 250 300 350 400 450 500

Fig. 1—Relation of A.S.T.M. true-boiling-point distillation curves

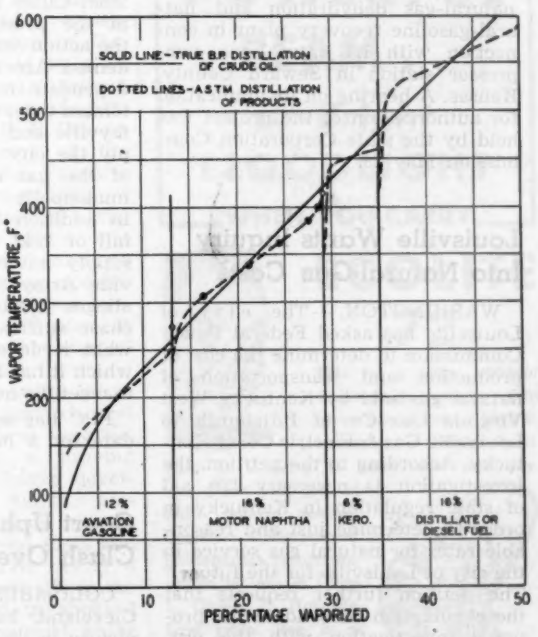

SOLID LINE—TRUE B.P. DISTILLATION OF CRUDE OIL
DOTTED LINES—A.S.T.M. DISTILLATION OF PRODUCTS
VAPOR TEMPERATURE, F°
100 200 300 400 500 600
12% AVIATION GASOLINE
16% MOTOR NAPHTHA
6% KERO.
16% DISTILLATE OR DIESEL FUEL
0 10 20 30 40 50
PERCENTAGE VAPORIZED

Fig. 2—A.S.T.M. distillation curves of products from crude oil (T.B.P.)

No. 44 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

Natural Gas

FPC Postpones Hearing in Central Illinois Case

WASHINGTON. — Federal Power Commission postponed until June 15 the hearing previously set for May 22 on (1) Central Illinois Public Service Co.'s amended petition for authority to construct its own facilities connecting its pipe lines with those of Panhandle Eastern Pipe Line Co. near Mattoon, Ill., in case FPC does not find sufficient evidence to warrant ordering Panhandle to construct similar facilities, as Illinois originally requested, and (2) Kentucky Natural Gas Corp.'s application for authority to construct and operate about 20 miles of 6-in. pipe line extending from a connection with Central Illinois' distribution system. Kentucky stated in its application that the facilities were needed to supply Central Illinois with additional gas.

Northern Natural Planning Natural-Gasoline Plant

TOPEKA.—Northern Natural Gas Co. is planning construction of a natural-gas dehydration and natural-gasoline recovery plant in connection with its natural-gas compressor station in Seward County, Kansas. A hearing on its application for authorization of the project was held by the state Corporation Commission May 29.

Louisville Wants Inquiry Into Natural-Gas Costs

WASHINGTON. — The city of Louisville has asked Federal Power Commission to determine the cost of production and transportation of natural gas sold by Kentucky West Virginia Gas Co. of Pittsburgh to Louisville Gas & Electric Co. of Kentucky. According to the petition, the investigation is necessary "in aid of state regulation in Kentucky in order to determine just and reasonable rates for natural gas service in the city of Louisville for the future." The petition further requests that the commission consolidate the proposed investigation with the proceeding arising on complaint of the city of Pittsburgh and the investigation instituted by FPC on its own motion to determine whether any natural-gas rates, subject to FPC jurisdiction, of Pittsburgh & West Virginia Gas Co. and Kentucky West Virginia Gas Co. are "unjust, unreasonable, unduly discriminatory or preferential." Hearing is set for June 11 in Washington on the complaint and investigation.

Wants FPC Aid to Get Gas From Cities Service

WASHINGTON.—Independent Industrial Gas Co., Independence, Kans., has filed a petition with Federal Power Commission for an order directing Cities Service Gas Co. to connect its facilities with those of Independent at a point near Coffeyville, Kans., and immediately to sell natural gas to Independent. The petition also requests approval of a contract between the two companies, dated October 16, 1944, providing for the sale of 1,000,000 cu. ft. of natural gas per day by Cities Service to Independent.

Union Gas Systems, Inc., which supplies a portion of Independent's natural-gas requirements and in turn receives a substantial volume from Cities Service, has intervened in the proceeding requesting that the action sought by Independent be denied. According to its petition, Independent numbers among its customers three industrial firms in Coffeyville and has a contract to supply the city of Coffeyville one-half of the gas needed to operate the municipally owned electric plant. In addition Independent, since the fall of 1942, has had a contract to supply natural gas to the Coffeyville Army air field. The company alleges it has been unable to purchase sufficient gas in addition to what it develops and owns or for which it has firm purchase contracts to meet the needs of these customers.

FPC has set September 6 as the date for a hearing.

Court Upholds East Ohio in Clash Over Death Claims

COLUMBUS.—East Ohio Gas Co., Cleveland, has won its first legal victory in its action to compel Ohio State Industrial Commission, which administers the workmen's compensation law, to pay death claims for 73 employes killed in an explosion of liquid gas in storage in Cleveland, October 20, 1944.

The Ohio Supreme Court ruled that the company in its petition, filed in the name of Marie M. Turner, widow of a victim, could properly plead it was denied equal rights under the federal constitution. The company contended the commission must pay the claims, inasmuch as East Ohio is compelled to contribute to the reserve fund for catastrophes maintained by the commission.

FPC to Hear Pittsburgh's Protest Against Gas Rates

WASHINGTON. — Federal Power Commission has instituted an investigation of natural-gas rates of the Pittsburgh & West Virginia Gas Co. and Kentucky-West Virginia Gas Co., following a complaint by the city of Pittsburgh. A public hearing is scheduled for June 11, in Washington. If the commission finds the companies' interstate wholesale rates unlawful, new rates will be fixed.

Natural Gasoline

Decline in Demand Affects Natural-Gasoline Output

WASHINGTON. — Influenced by the seasonal decline in demand, the daily average output of natural gasoline and allied products in March — 12,902,000 gal.—was 2 per cent below that of February. Decreases were recorded in the Panhandle, Texas Gulf, Oklahoma, and the eastern states. Demand for light products nearly equaled the production and receipts at plants. Production of commercial butane-propane and propane showed the greatest ratio decrease. Demand for natural gasoline at refineries and finished gasoline and naphtha for trade outlets rose and liquefied petroleum gases for fuel dropped.

PRODUCTION
(Thousands of gallons)

	March	Feb.
Natural gasoline	178,682	161,409
Natural gasoline mixture	30,119	26,690
Raw condensate	38,519	35,632
Liquefied petroleum gases:		
Commercial butane-propane mixture	24,324	25,424
Normal butane	41,652	38,205
Propane	23,015	22,446
Other mixtures (L.P.G.)	13,264	11,562
Isobutane	14,781	13,229
Isopentane	12,911	12,053
Finished gasoline and naphtha	19,265	17,824
Other products	3,432	3,158
Total	399,964	367,632

REFINING

No Improvement in Civilian Gasoline in Sight Yet

WASHINGTON. — Civilians will have to go on running their automobiles on gasoline of present octane ratings, Ralph K. Davies, deputy petroleum administrator, says, owing largely to the heavy demand for metallic lead for various war materials, including the batteries vital to tanks, military trucks and Navy vessels.

Metallic lead is an ingredient of tetraethyl lead, an antiknock compound. It is necessarily used in considerable quantity in 100-octane aviation gasoline, and as the operations of the U. S. air forces have expanded, the military requirements have steadily increased.

"Over 75 per cent of the tetraethyl lead now manufactured is going into military gasoline, and the remainder into civilian grades," Davies explained. "This is a complete reversal of the prewar ratio."

Gulf Coast Gasoline Stocks Register Modest Rise

HOUSTON.—Stocks of all grades of gasoline and naphthas registered a modest rise at plants in Gulf Coast Refiners Association during the first half of May. They were reported at 1,384,347 bbl., up to 44,394 from the April 30 level. Automotive gasoline stocks were 517,465 bbl., an increase of 34,326. Total stocks of all products were 3,231,684 bbl., up 371,055. A year ago the total was 3,254,780. Crude runs totaled 128,111 bbl. daily.

Plans for Oil-Shale Plant Taking Definite Shape

WASHINGTON. — Plans for the $1,500,000 oil-shale demonstration plant to be built near Rifle, Colo., as part of the synthetic-fuels program of Bureau of Mines are assuming definite form. Dr. R. R. Sayers, director of the bureau, reports completion of rights-of-way surveys and maps, office building specifications, and water and power system designs, as well as placement of equipment orders and the start of truck-trail construction.

BOYD GUTHRIE

This plant, to be operated jointly with an oil-shale research and development laboratory at Laramie, Wyo., will serve as a proving ground for processes being developed to convert the nation's immense reserves of oil shale into an auxiliary source of liquid fuels and lubricants. A truck trail nearly 8 miles long from the plant site to the mine, to be completed in about 3 months, will be of material value in getting heavy equipment and personnel to the mine and in building a 1½-mile-long aerial tramway to carry shale from mine to plant.

Boyd Guthrie, supervising engi-

We design and construct all types of modern refining units.

★ Serving the Industry Since 1915

BORN ENGINEERING CO.
Tulsa, Oklahoma

GUNITE METHOD
SAND AND CEMENT
"Placed by Air"
WRITE — PHONE — WIRE
FOR SERVICE — INFORMATION
GUNITE CONCRETE & CONSTRUCTION COMPANY
1301 Woodswether Road, Kansas City 6, Mo.
Distr. Br. Office: 228 N. LA SALLE, CHICAGO • *Branch Offices:* ST. LOUIS, DENVER, NEW ORLEANS, DALLAS, HOUSTON
"GUNITE" CONCRETE SINCE 1915

The "HOW TO BOOK" *about tube cleaning*
YOURS FOR THE ASKING—

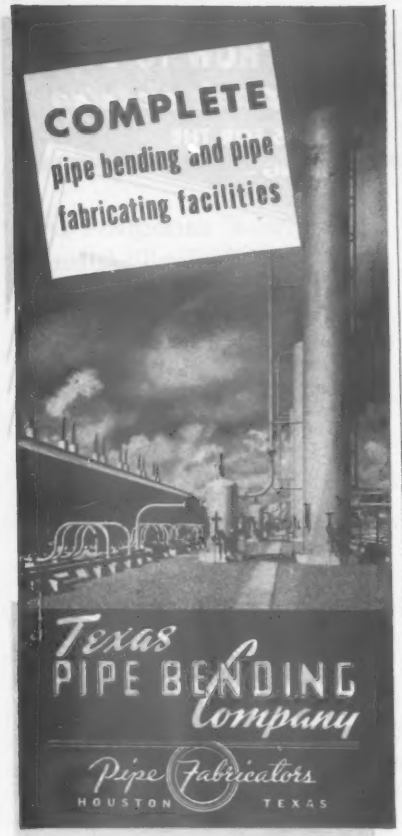
ELLIOTT Company
Tube Cleaner Dept.
SPRINGFIELD, OHIO
District Offices in Principal Cities
Y-239

POWERFUL BEAM . . or Bright FLOODLIGHT WHEN YOU CARRY

ECOLITE 72

This is a safe, efficient economical lantern that gives you a strong 1500 ft. beam or a bright floodlight. It is easy to carry, tilts and pivots, gives you lots of light where needed. Carries Underwriters' Laboratories recommendation for use in Class 1 Group D Hazards. Low price. See it at once. At Oil Well Supply Stores.

ECONOMY ELECTRIC LANTERN CO.
3100 W. CHERRY ST., MILWAUKEE 8, WIS.



neer for the project, was associated with the bureau's first oil-shale project at Rifle in 1928-29. He graduated from University of Utah in 1925 with a degree in chemical engineering. In 1936 he was made assistant chief of the petroleum chemistry and refinery section at the petroleum experiment station in Bartlesville, Okla. Early in 1944 he was assigned to the Washington, D. C., office to assist in planning the present oil-shale project and later was appointed supervising engineer.

Refinery-Cost Study to Be Based on Over-all Profit

WASHINGTON. — The Office of Price Administration, in cooperation with the Refinery Industry Advisory Committee, will go ahead with a cost study of over-all profits to determine the industry's ability to absorb any price increase which may be granted to crude-oil producers, it was learned this week.

OPA, however, rejected the committee's recommendation that the survey cover only profits of refineries. The agency's position is that only over-all earnings of all activities of integrated companies can be used to determine the industry's profit position.

The committee last week submitted its report to OPA, with the statement that the group will work further on a cost study if the agency wants it done.

Urging that the study be made as quickly as possible, Orville Judd, associate director of the fuel-price division, pointed out that in the event the results of the crude-oil-cost study now being made calls for a price increase, such an advance would go into effect immediately without waiting for information on the ability of refiners to absorb it.

The committee will submit additional suggestions for the survey, Judd said, covering all phases of marketing, production, pipe-line activities, etc., as a substitution for the form proposed to cover only refinery costs.

"Fantastic figures on refinery profits, bandied about both in official and industry circles, are not likely to be borne out by such a study," Judd said, referring to references to profits of 60 to 75 cents a barrel supposedly realized by some integrated companies.

"Many reported earnings," Judd said, "have been given without taking renegotiation into consideration. Renegotiation will bring any 'abnormal' profit in the refinery field down to normal."

Returns have been slow on the crude-oil-cost study, which is due June 1, Judd said.

IT'S THE INSIDES OF YOUR STORAGE TANKS THAT COUNT!

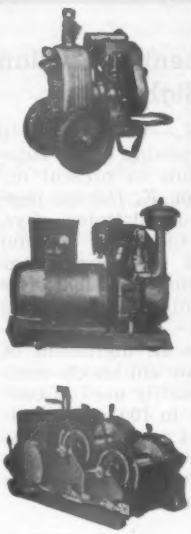
. . . GET THEM CLEANED BY GENERAL TANK SERVICE

. . . specialists in the speedy removal of tank sediments . . a patented vacuum pump turns the heaviest sludge into fluid which may be processed for maximum recovery.

General Tank Service supplies all the equipment and labor to do a speedy and efficient job.

GENERAL
TANK SERVICE, INC.
123 WILLIAM ST., NEW YORK 7

LEADING CONTRACTORS PREFER
Sterling
PUMPS · HOISTS · LIGHT PLANTS



SIMPLE
RUGGED
DEPENDABLE
•
EASY TO OPERATE
•
DO MORE WORK AT LESS COST
•
WRITE FOR CATALOG TODAY

STERLING QUALITY

STERLING
MACHINERY CORPORATION
405 12 SOUTHWEST BLVD. KANSAS CITY 10, MO

OIL and GAS
BURNING EQUIPMENT
NATIONAL
AIROIL
BURNERS
1236 E. Sedgley Ave.
PHILADELPHIA 34, PENNA.

Steel Plate
Fabricators and
Contractors
•
Products storage
•
Pressure vessels
McNAMAR
BOILER & TANK CO.
Tulsa, Okla

OAKITE Degreasing Speeds SALVAGE!

Cleaning used valves, fittings, elbows . . . coated with rust, oil, dirt, grease and carbon . . . is another formidable salvage problem Oakite materials have solved. There may be many hours of service left in these used parts . . . and there is an Oakite cleaning technique to ready them for inspection quickly and easily.

Fast-working Oakite degreasing and derusting materials cut away the most tenacious deposits, leave the base finish completely exposed. You can see at a glance the true condition of the part . . . speedily make any necessary repairs.

Let us send you complete details on this timely salvage cleaning task. We shall be glad also to furnish interesting data on ways to speed up many maintenance and related cleaning operations. No obligation, of course.

OAKITE PRODUCTS, INC.
44C Thames Street, New York 6, N.Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

Stop fire with DUGAS EXTINGUISHERS

Charged with PLUS-FIFTY DUGAS Dry Chemical

This is fast-acting protection that is YOUR safeguard against fire loss when you own a DUGAS EXTINGUISHER.

READY FOR ACTION . . . Dugas units are mobile, easy to handle and simple to operate. They never freeze up in winter; never require periodic recharge . . . yet can be quickly recharged on the spot.

SAFE . . . the dry chemical rolls up a heat-shielding screen for the operator and at the same time chokes the fire . . . it is non-toxic, non-corrosive, non-abrasive, and is not an electrical conductor.

FOR EXTRA-HAZARDOUS FIRES . . . in flammable liquids, solids and gases, and in electrical equipment.

Approved by Underwriters' Laboratories, Factory Mutual Laboratories, and Governmental Agencies.

AN ANSUL PRODUCT
duGas
THE MASTER OF FLAME

DUGAS 15-T HAND EXTINGUISHER

DUGAS 150 WHEELED EXTINGUISHER

ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION

Reilly
PIPE ENAMEL
FOR
DEPENDABLE
PROTECTION
On Oil, Gas, Gasoline
and Water Lines
Reilly
COAL TAR
PRODUCTS
17 PLANTS
To Serve
THE NATION
REILLY TAR & CHEMICAL
CORPORATION
Merchants Bank Bldg., Indianapolis
500 Fifth Ave., New York • 2513 S. Damen Ave., Chicago

Cut & Bevel Any Pipe
With
Maximum SPEED
Minimum COST

The H & M PIPE CUTTING
and BEVELING MACHINE

SPEED: Complete cut and bevel can be made on 12 inch pipe in about 2 minutes.
ECONOMY: Save approximately one-half labor and gas costs.
PORTABILITY: Can easily be carried from one pipe section to another.

Write for Literature

The H & M
Pipe Beveling Machine Co.
611 Petroleum Building, Tulsa, Oklahoma

PIPE LINES

Utah Awards Contracts For Rangely Pipe Line

Utah Oil Refining Co. let contracts for the laying of approximately 151 miles of 10-in. from the Rangely field, Colorado, to Wamsutter station, Wyo., of the Fort Laramie, Wyo.-Salt Lake City, Utah, crude oil trunk line.

Anderson Brothers Construction Co. will lay 41 miles starting from Rangely as well as the gathering lines in the Rangely pool itself. R. H. Fulton Co. will lay the middle section of 50 miles and will take up 18 miles of 4-in. between Iles and Craig, Colo. Sharman & Allen will lay 60 miles at the Wamsutter end.

Work on the right-of-way was started this week. Pipe laying will begin when pipe arrives about July 1. The project will be completed September 15.

The Anderson Brothers company is now engaged in operations for building 25 miles of 8-in. to loop the 6-in. section of the main trunk line between Uintah Junction and Salt Lake City.

High Speed Pumps for Utah's Rangely Line

Departures from standard practices have been made in planning for pump installations for moving Rangely, Colo., crude oil in connection with the project of Utah Oil Refining Co. for delivering via a line to be built this summer and through the trunk line from Wamsutter to Salt Lake City.

Pumping through the 151-mile 10-in. line to Wamsutter will be done entirely by two units to be installed at Rangely. These units are to be furnished by Cooper-Bessemer Corp. Each has a new type of high-speed 3-in. by 3-in. reciprocating pump with 10 horizontal cylinders. The pump will be driven by a gas-diesel engine without reduction gears. The unit has been designed to operate between 400 and 500 r.p.m. at 1,400 psi. For the initial loads anticipated it is expected that both units will be operated at 360 r.p.m. If one should be shutdown, the other one could function satisfactorily in an emergency by operating at a higher speed.

For increasing the capacity of the Wamsutter-Salt Lake City section of the main trunk line two units are to be installed, one at Wamsutter station and the other at Granger station, Wyoming. Each of these will have a high-speed pump of Aldrich Pump Co. with a 6-in. stroke operating at 240 r.p.m., regarded as having a relative distance speed equivalent to 480 r.p.m. of a pump with a 3-in. stroke. The pump will be connected with reduction gears to a Worthington Pump & Machinery Co. diesel engine operating at 375 r.p.m. One of these pumps will be operated at 1,500 and the other at 1,600 psi.

Court Stops Memphis Project Again

An order staying work on the extension of pipe-line facilities of the Memphis Natural Gas Co. between Monroe, La., and Memphis, Tenn., was signed last week by Judges Leon McCord and Edwin R. Holmes of the U. S. Fifth Circuit Court of Appeals at New Orleans.

The order, sought by the Louisiana Public Service Commission and the State Department of Conservation, would be in effect until disposition of the long-litigated case by the U. S. Supreme Court.

It would again halt construction on a project approved by the Federal Power Commission last November and stayed by the Fifth Circuit Court December 22, 1944.

The 1944 stay became ineffective after the same court upheld the FPC approval March 31 and denied the Louisiana agencies application for a rehearing April 18.

The company proposes to double its transmission lines from the Monroe field to Memphis and West Tennessee consumers and install additional facilities between Monroe and Lisbon, La. Construction of loop and lateral lines had been contracted by N. A. Saigh Co.

Stanolind Seeks Permit For Circle Ridge Outlet

DENVER. — Stanolind Pipe Line Co. has applied to the Wyoming Public Service Commission for permission to construct an oil pipe line in Fremont County, Wyoming, from the Circle Ridge field through the Maverick Springs, Steamboat Butte, Pilot Butte and Winkleman Dome pools to the Husky refinery at

WHEN YOU WANT THE BEST IN PIPELINE CONSTRUCTION

Oklahoma CONTRACTING COMPANY DALLAS, TEXAS

SOUTH AMERICA
Apartado 1085
CARACAS, VENEZUELA

MOLE
Pipeline
Cleaner

For BETTER cleaning of
CRUDE LINES
PRODUCT LINES
NATURAL GAS LINES

FOR DETAILS WRITE

Pipeline Cleaners Co.
Fort Madison, Iowa

Riverton, Wyo., and then to a connection with its Elk Basin-Casper line. Last week Toronto Pipe Line Co. withdrew its application for permission to build from Steamboat Butte and Pilot Butte to Shoshoni. The two moves indicate an agreement to widen the scope of the project so as to take in a much larger territory and to serve more fields. Hearing has been set for June 13.

Texas-New Mexico Installs Superchargers on Engines

In connection with the program for increasing capacity of the Crane-Houston, Tex., crude-oil line, for which 30 miles of loops have recently been laid, Texas-New Mexico Pipe Line Co. is increasing the horsepower of pump station diesel engines by the installation of superchargers. It is reported that three superchargers are to be installed at each station. The work has progressed to a point where more than half of the supercharger installation program has been completed.

Cole Bill Extension Date to Be Determined

The Senate has passed and returned to the House for conference a bill to extend the time limit on the President's emergency powers to acquire petroleum pipe-line routes by eminent domain. The Senate version extends the power to June 30, 1946. The House passed a version extending it to June 30, 1947.

English Channel Lines Laid From Spools

The unusual methods for laying 20 lines of 3-in. diameter by the British Government across the English Channel by means of floating spools for handling flexible pipe are described in an article appearing elsewhere in this issue.

Robinson-Indianapolis Line Facilities Near Completion

Operation is now being conducted at a low throughput rate for the 105-mile 8-in. refined products pipe line undertaken by Ohio Oil Co. and later acquired by Buckeye Pipe Line Co., which extends from Robinson, Ill., to Indianapolis, Ind.

The Ohio Oil Co. Indianapolis truck terminal will not be entirely completed until early in June. Six 20,000-bbl. and two 55,000-bbl. tanks have been completed; an additional 20,000-bbl. tank will be completed in June. The tank-car loading rack is in the process of being completed.

ADECO
NOZZLE TESTER
Keeps Diesel Engines Running Efficiently

TESTS FUEL INJECTORS AND HYDRAULIC DEVICES
At Pressures Up To 10,000 p.s.i.

To keep diesel engines operating at peak efficiency, this portable, precision-built Adeco Nozzle Tester is indispensable.

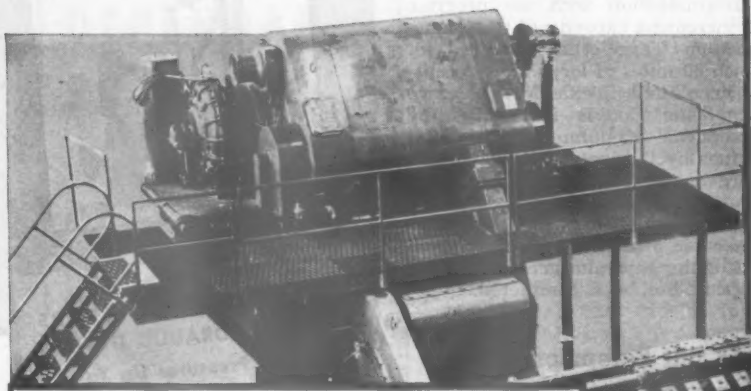
Light in weight yet built for heavy-duty service, it enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Tests both large and small injectors, on bench or engine, at pressures up to 10,000 p.s.i. Prevents costly delays and possible damage to engine.

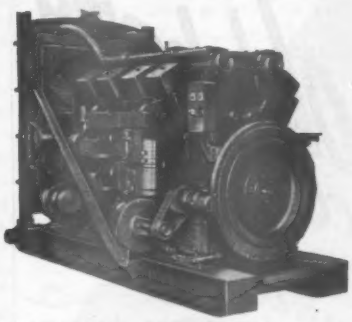
Ideal for testing hydraulic devices.

Write for bulletin on this practical, low-cost unit.

ADEC
AIRCRAFT & DIESEL EQUIPMENT CORP.
4411 NO. RAVENSWOOD AVE.
CHICAGO 40, ILLINOIS

DRILL
DEEPER...FASTER...CHEAPER
with CLIMAX "V" SERIES Engines





CLIMAX VU-280 delivering 280 h.p. at 1100 r.p.m. with radiator, fan and power take-off.

CLIMAX VU-420 delivering 420 h.p. at 1100 r.p.m. with radiator, fan and power take-off.

STURDY, rugged, compact Climax V-8's and 12's have extra power for load peaks — STAYING POWER that speeds up and cuts the costs of deep drilling.

Climax Engines of today—operating with unmatched economy and efficiency on natural gas, by-product gas, butane or gasoline—give you the *added dependability* and *sustained power* that result from exclusive Blue Streak Hi-Power Combustion, Dual Ignition, and Hi-Efficiency Dual Carburetion. They are instant starting, fast accelerating, smooth running, flexible, *dependable* prime movers. Investigate Climax performance before you invest in any engine. For bulletins, write Climax Engineering Company, Clinton, Iowa.

Regional Offices:
CHICAGO • DALLAS • FT. WORTH
NEW YORK • LOS ANGELES.

Climax Built-in EXTRAS
AT NO EXTRA COST

1 **Hi-Power Blue Streak Combustion and Dual Carburetion.** Increased power and lower fuel consumption throughout the speed range.

2 **Twin Ignition.** Two independent ignition systems assure continuous operation.

3 **Cylinders Cast in Pairs** with removable wet liners.

4 **Instant Accessibility** for operating adjustment and servicing.

MID-CONTINENT DISTRIBUTOR
The Continental Supply Company
General Offices, Dallas

CALIFORNIA DISTRIBUTOR
Climax Engines & Parts Company
2050 Santa Fe Ave., Los Angeles

Climax BLUE STREAK ENGINE
Builder of Climax DIESELS and GENERATING SETS

CLIMAX ENGINEERING COMPANY

Exploration and Drilling

Week's Highlights

CITIES Service Oil Corp., Phillips Petroleum Co., and Mid-Continent Petroleum Corp. 1 Lawson, SW NW 22-5-4w. southern McClain County, Oklahoma, is attracting attention as a result of a drill-stem test at 9,959 ft., which is reported to have shown gas with a spray of condensate. Information, other than total depth, has been officially withheld, but it seems likely the formation tested was the Chimney Hill, or basal section of the Hunton lime.

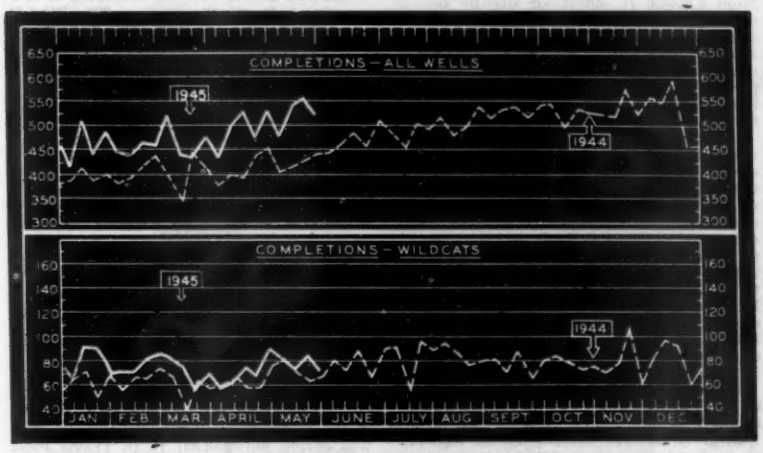
This test is a part of a gradually developing exploration play in the southeastern part of the Anadarko basin, which covers about 140,000 square miles, but is roughly egg shaped, with the narrow end of the egg pointing southeast and ending at the Arbuckle mountains in south central Oklahoma. Near the converging point there are oil and gas fields on the southwest rim, Knox, Chickasha, Cement, and others.

On the northeast rim, nearing the converging point, are the Pauls Valley, East Pauls Valley, Cottingham, and West Noble fields, with the Cities Service et al test lying in between the Pauls Valley fields and the others in a north-south direction, but west of all of them.

Between the northeast and southwest rims of the basin, the formations dip steeply into the bottom of the basin, although the dip from the northeast rim is more gradual, throwing the axis of the basin geosyncline nearest the southwest rim.

If production in a string of pools can be established along the northeast rim in the area where the basin is narrowest, then important possibilities open up. There are already fields on the southwest rim, and if conditions were favorable for oil on both rims where they are only a few miles apart, any lines of folding between the rims, deep in the basin, would be likely prospects.

If these deeper basin folds should be tested and found productive, then by fanning out northwest by progressive steps from the narrowest end of the basin, the whole 140,000 square miles might be tested a step at a time, with much less risk. Since general basin testing will call for very expensive holes of 10,000 to 15,000 ft. depths, minimizing of risks is important.



Solid line charts current weekly completions, service wells in Eastern area included

COMPLETIONS IN ALL FIELDS . . .

Week ended May 26, 1945

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1945	1944
	Oil	Gas	Dry	Total	Footage	1945	1944
New York	18	0	*18	36	50,115	511	‡352
Pennsylvania	41	5	†35	81	145,110	1,476	‡725
West Virginia	5	11	0	16	41,157	311	185
Ohio	3	6	8	17	41,755	314	364
Indiana	2	0	4	6	9,760	65	85
Kentucky	4	1	5	10	22,260	147	239
Illinois	19	0	10	29	73,504	327	637
Michigan	1	0	8	9	18,073	295	228
Kansas	22	0	11	33	117,392	616	661
Nebraska, Missouri, Iowa	0	0	0	0	0	12	13
Oklahoma	33	3	28	64	288,926	941	630
Texas:	81	7	44	132	631,186	2,851	2,045
North Central	24	0	17	41	114,928	816	559
West	25	1	7	33	162,551	762	605
Panhandle	5	2	0	7	21,601	224	72
Eastern	2	1	0	3	22,649	122	127
Gulf Coast	19	3	12	34	250,917	664	375
Southwest	6	0	8	14	58,540	263	307
Louisiana:	12	1	10	23	193,159	368	291
Northern	2	1	3	6	31,302	118	110
Southern	10	0	7	17	161,857	250	181
Arkansas	2	0	1	3	10,789	67	85
Mississippi	3	0	3	6	38,735	136	42
Southeastern States	1	0	1	2	7,339	16	14
Montana	3	2	0	5	9,897	126	101
Wyoming	3	0	2	5	28,541	83	61
Colorado-Utah	1	0	0	1	6,428	13	12
New Mexico	4	0	0	4	11,689	193	163
California	30	1	8	39	148,512	930	766
Total United States	288	37	196	521	1,894,337	10,098	7,697
Total previous week	303	55	199	557			
Total May 27, 1944	234	46	122	402			

Service wells included: *36, †33. ‡Does not include pressure wells.

N. CENTRAL TEXAS

Second Producer Added In New King County Pool

WICHITA FALLS. — Mid-Continent Petroleum Corp. 1 Burnett, wildcat 3 miles southwest of the Ross pool in King County, drilled oil saturated lime from 5,920-30 ft. On a 25-minute drill-stem test from 5,914-30 ft., 40 ft. of slightly oil-cut drilling mud was recovered. It was drilling below 6,059 ft. in chert. Ohio Oil Co. 2 W. R. Ross, offset to 1 Ross, recent discovery well in King County, was completed for 135 bbl. of 36.9-gravity oil in 3 hours. Pay zone is from 5,304-64 ft. in the Strawn.

Continental Oil Co. 1 Roy Cherryhomes, wildcat in the J. Irvine Survey, northeastern Jack County, drilled conglomerate with stain and odor of oil from 5,658-63 ft. On a 45-minute drill-stem test, 40 ft. of drilling mud with no oil or water was recovered. It was drilling below 5,766 ft. in shale. Continental 1-A T. H. Cherryhomes, R. S. Corder Survey, east offset to Panhandle Producing & Refining Co. 1 Cherryhomes, recent discovery in southeastern Jack, has been completed to flow 154 bbl. of 42-gravity oil in 24 hours. Production was through perforations from 5,032-54 ft.

The Texas Co. 1 Buckley, wildcat 15 miles northeast of Gainesville, Cooke County, drilled sand showing oil from 7,427-37 ft. It was drilling ahead at 7,529 ft. in hard lime. Sun Oil Co. 1 Field 1-mile-south outpost to the Sivell's Bend pool, Cooke County, was drilling below 5,498 ft. in broken sand and shale. Mid-Continent 1 T. L. Burnett, wildcat 6 miles north of the Johnson pool in Foard County, was drilling below 6,588 ft. in lime and shale.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Dillard & Wood 1 C. E. Carter, Lot 39, Blk. 5, Clark & Plumb subd., 3 mi. E and 1 mi. S Archer City, dry, TD 1,155 ft.

Clay County: Bridwell Oil 1 Vaughn-Holt, Blk. 3, J. H. Belcher subd., 5 mi. SW Blue Grove, elev. 1,108 ft., Caddo 5,488 ft., Simpson 5,841 ft., dry, TD 6,041 ft.

Montague County: NuEnamel Operating Co. 1-A Will Laird, R. T. Millard Sur. A-470, 8 mi. S and ½ mi. W Bowie, dry, TD 4,963 ft.

Young County: Dunlap & Graham 1 C. J. Taack, Sec. 248, TE&L Sur. A-495, 7 mi. S Olney, elev. 1,156 ft., Palo Pinto 2,000 ft., dry,. TD 3,014 ft.

WEST CENTRAL TEXAS WILDCAT FAILURE

Stonewall County: Norris Stamping & Mfg. Co. 1 R. S. Ward, Sec. 292, Blk. D, H&TC Sur., 15 mi. NW Aspermont, dry, TD 5,301 ft.

EASTERN TEXAS

Shelby County Wildcat Shows Gas-Cut Mud, Oil

DALLAS.—J. C. Benedum 1 Pickering Lumber Co., wildcat 6 miles east of Patroon in Shelby County, took a 40-minute drill-stem test from 3,638-40 ft. and recovered 450 ft. of gas-cut mud and a small amount of oil-cut mud in the bottom 30 ft. On a 60-minute drill-stem test from 3,643-48 ft., 330 ft. of gas-cut mud and a trace of oil was recovered. Humble Oil & Refining Co. 1 Pickering, wildcat in the S. Francois Survey, Shelby County, was coring below 8,851 ft. in Travis Peak with no shows reported.

W. H. Mitchell 1 Borders Unit, 5 miles southwest of Deadwood in Panola County, ran a 60-minute drill-stem test from 5,940-56 ft. in the Travis Peak zone. An estimated 15 bbl. of 40-gravity oil was recovered. It will be plugged back from total depth of 6,150 ft. to test the Pettit zone. The Texas Co. 1 Dr. W. N. Sneed, southwest outpost to 1 McKnight, gas-distillate discovery well in Freestone County, logged its first porous zone from 8,157-76 ft. and the second at 8,217 ft. No shows were reported in coring below 8,226 ft.

DAILY AVERAGE PRODUCTION FOR WEEK

	May 26 crude oil	Distillate, allied products	May PAW quota all oils	May 19 crude oil
Alabama	450	.....	300	450
Arkansas	80,000	5,200	85,200	79,800
California	940,150	60,280	1,007,280	945,250
Colorado	11,100	.....	10,500	10,450
Eastern	64,900	6,600	73,800	63,300
Illinois	197,600	12,000	217,000	194,250
Indiana	12,800	.....	13,000	12,650
Kansas	275,100	4,200	278,200	271,300
Kentucky	27,500	2,200	33,200	26,600
Louisiana	370,000	42,000	402,000	370,900
North Louisiana	70,250	.....	.....	71,100
South Louisiana	299,750	.....	.....	299,800
Michigan	46,600	700	47,700	45,800
Mississippi	49,800	.....	53,000	49,800
Montana	23,150	300	23,300	23,550
Nebraska	900	.....	1,000	900
New Mexico	103,700	4,800	109,800	103,700
Oklahoma	385,700	28,500	396,000	385,400
Texas	2,176,150	162,000	2,332,000	2,176,150
East Texas	379,800	.....	.....	379,800
East Central Texas	138,200	.....	.....	138,200
North Central Texas	153,900	.....	.....	153,900
Texas Panhandle	90,000	.....	.....	90,000
West Texas	495,300	.....	.....	495,300
Southwest Texas	355,650	.....	.....	355,650
Texas Gulf Coast	563,300	.....	.....	563,300
Wyoming	102,450	3,200	115,200	102,550
Total United States	4,868,050	331,980	5,198,480	4,862,800
Change from previous week	up 5,250			

Total production January 1-May 26, 1945 ..... 697,506,300 bbl.
Same period last year ..... 650,255,261 bbl.

PERMIAN BASIN

San Andres Produces in Northwestern Andrews

MIDLAND. — Chalmette Corp. 1 Lake Shore Corp., opening production from the San Andres in northwestern Andrews County, swabbed 57 bbl. of oil in 24 hours after acidizing through perforations from 4,530-4,650 ft. Pump was being installed. The well was plugged back to 4,767 ft. from total depth of 7,636 ft. The wildcat is 1½ miles north of the Fullerton pool and the same distance east of the Union pool.

Shell Oil Co., Inc. and The Texas Co. 1 Ratliff & Bedford, prospective producer from the lower Permian, Devonian and Silurian in southwestern Andrews, was drilling below 10,255 ft. in lime and shale.

Humble Oil & Refining Co. 88-X Means, deep test in the Means field of northeastern Andrews, was drilling below 10,945 ft. in lime and shale.

Frank and George Frankel have staked a 9,000-ft. wildcat 1 mile south of Devonian production on the south end of the Fullerton pool. It is 1 University in Section 32, Block 13, University Lands.

Humble 1 Parrott, deep discovery in eastern Upton County, having failed to get a sustained flow through perforations from 9,100-9,884 ft., made new perforations from 9,410-9,860 ft. Testing will be resumed. Humble 1 Gresham, wildcat 1 mile west of 1 Parrott, was drilling below 8,620 ft. in shale.

Continental Oil Co. D-1-133 Settles, deep discovery well for the shallow Howard-Glasscock field in southern Howard County, flowed 38 bbl. of oil in 6 hours and died. It was then treated with 6,000 gal. of acid from 9,100-20 ft. and was being swabbed and tested.

Phillips Petroleum Corp. 1 McDowell, northwest central Glasscock County wildcat, flowed 16 bbl. of fluid, approximately 95 per cent oil and the balance drilling mud, per hour for 24 hours at 6,761 ft. Operator will continue to test. It may be deepened to the Ellenburger.

Cities Service Oil Co. 1 Mrs. E. R. Thomas, east offset to the TXL pool discovery well, western Ector County, swabbed and flowed 83 bbl. of oil plus 7 bbl. of acid residue in 24 hours through perforations from 7,870-7,940 ft. It was retreated with 8,000 gal. of acid and is being swabbed and tested. Total depth is 8,080 ft. Shell and Cities Service 1-B TXL, 1½ miles south of the discovery well, was drilling below 8,027 ft. in lime with no shows reported. Amerada Petroleum Corp. 1-B TXL, Section 17, Block 45, T-1-S, T&P Survey, is a new test for the pool. It is ¾ mile northwest of Phillips 1 TXL, which showed for production from the Silurian and the Ellenburger, but is scheduled to complete in the Ellenburger.

Ledge Petroleum Co., Inc. 1 G. Bouscaren estate, deep discovery well in the Noelke pool of western Crockett County, showed fair porosity and saturation in samples from 3,961-4,042 ft. At total depth of 4,051 ft., the hole filled 3,000 ft. with oil. It was shot with 240 qt. from 3,961-4,042 ft. It was cleaning out with 3,800 ft. of oil in the hole. Richfield Oil Co. 1 Bean, wildcat 6 miles northeast of the Todd pool in northeastern Crockett, failed on a drill-stem test at 8,632 ft. in lime and shale and was attempting to run another.

WEST TEXAS SUCCESSFUL WILDCAT

Garza County: Extension to old oil pool—Karcher & Brown 1 Post est., Sec. 7, Blk. 5, K. Aycock Sur., 1½ mi. SW Garza pool, elev. 2,643 ft., pumped 160 bbl. day through 2-in. tubing, perf. 2,877-2,936 ft. San Andres, gravity 36°, TD 2,936 ft.

WEST TEXAS WILDCAT FAILURES

Cochran County: Texas 2-H Mallett, Sec.

"Best Bet Yet"

These oil-proof, wear-resistant, plastic tubing protectors are an integral part of the tubing collar. Made in all sizes, they prevent the metal-to-metal contact that has caused many expensive "wet" jobs in pumping wells in the past.

PATTERSON-BALLAGH
TUBING PROTECTORS
LOS ANGELES 1 • HOUSTON 10 • NEW YORK 6

ALTEN
Four-Bolt Forged Steel
POLISHED
ROD CLAMP

Fig. F-613

ONE OF OVER 300 ALTEN
OIL FIELD PRODUCTS

See Composite Catalog
for complete list or
write us for catalog.

ALTEN'S
FOUNDRY and MACHINE WORKS
Established 1889 . . . . . Lancaster, Ohio
EXPORT OFFICE:
342 Madison Ave.,
New York 17, New York
TEXAS OFFICE:
45 San Jacinto St.,
Houston 1, Texas
Leading Supply Stores Carry All Alten Oil Field Equipment

do your
MENTAL BUYING
now!

In making future plans, you'll want to use the light-weight pipe that can give you proved performance.

One look at the wartime record of Naylor Pipe in supplying fuel, oil and water on the fighting fronts will tell you why Naylor is the pipe that can do a better job for you. You'll like its light weight. Its greater strength. Its safety. Its leaktightness. Its speed and ease of installation. Its savings in steel, time, maintenance and money. It will pay you to include Naylor Pipe in your plans for future requirements.

Specify Naylor for de-watering, gas and oil lines, gathering lines, salt water disposal, sludge lines, vacuum lines, threaded surface casing, syphon pipe, tank gauge and tank swing pipe. Sizes from 4" to 30" in diameter—lengths up to 40 feet. All types of fittings, connections and fabrications.

NAYLOR LOCKSEAM
SPIRALWELD PIPE

NAYLOR PIPE COMPANY
General Office
1222 EAST 92ND STREET • CHICAGO 19, ILLINOIS
New York Office
350 Madison Avenue • New York 17, N. Y.

8, Blk. G, PSL, outpost Slaughter pool, elev. 3,624 ft., dry, TD 5,140 ft.

Howard County: Hunt Oil Co. 1 A. L. Wasson, Sec. 19, Blk. 29, T&P Sur., 4 mi. N Iatan-East Howard field, elev. 2,274 ft., San Andres 2,086 ft., Glorietta 2,850 ft., dry, TD 4,643 ft.

McCulloch County: George W. McClung 1 Delia Crawford, Sec. 1321, H. Spiller Sur., dry, TD 1,560 ft.

SOUTHEASTERN NEW MEXICO

HOBBS. — Continental Oil Co. 3-B-23 Skaggs, in the Skaggs field of southeastern Lea County, was completed for 1,938 bbl. of 41.7-gravity oil in 24 hours. Gas-oil ratio was 396 to 1. Pay was topped at 7,667 ft. Total depth is 7,698 ft. This is the second producer from the Wolfcamp in the Skaggs field. The Texas Co. 1 Blineberry, on the northwest side of the Penrose Deep field in Lea, made 12 bbl. of oil with shakeout of 4 per cent basic sediment through a ¼-in. choke during a 2½-hour flowing test. Later, on a 5-hour flow through casing, it recovered 19 bbl. of oil. The flowing tests were from 5,580-95 ft. The casing was perforated from 5,610-25 ft. and operator was continuing testing work.

Phillips Petroleum Corp. 4 Lea-Mex, wildcat northeast of the Maljamar field in Lea County, was drilling below 12,199 ft. unchanged. Texas 1 J. S. Eaves, wildcat 14 miles north of Hobbs, was drilling ahead at 8,133 ft. in lime. Humble Oil & Refining Co. 2 Federal-Leonard, wildcat in the Dublin area, was drilling below 8,861 ft. in lime.

Check this
simple AMERICAN setting arrangement!
You can see (below) how easily this Type G Packer sets! You simply turn to the right and set down (left-hand set can be furnished when specified)! There's no chance of getting hung up. The key is so much smaller than the slot in which it operates, it can't get clogged up or fouled! Friction springs are extra large! Also note (at left) large, carefully heat-treated slips; large bottom guide, and full tubing-size opening thru packer!
AMERICAN
IRON AND MACHINE WORKS CO.
OKLAHOMA CITY, OKLAHOMA
Office and Warehouse, Houston, Texas; Export Office: 420 Lexington Avenue, New York City, N.Y.; California Representative: Hopper Machine Works, Inc., Bakersfield, California

MICHIGAN

Natural Gas Prospect Attracts Four Locations

SAGINAW.—Extensive new development of the Marion Township natural gas prospects in Osceola County are scheduled by Taggart Bros. Co. of Big Rapids. The firm obtained from the state conservation department four of the 19 drilling permits issued last week. Three new permits also were issued for Isabella County oil tests, two in the Coldwater pool, the other in Union Township. Other permits are: Two each for Gratiot and Mecosta counties, one each for Huron, Midland, Muskegon, Kalamazoo, Van Buren, Montcalm and Ottawa.

Field activities were slack last week with only nine recorded completions and only one producer. Four of the dry holes were wildcat tests. In addition, an exhausted producing well in Foster Township, Ogemaw County, was deepened to nearly 4,200 ft. in an exploration of lower strata. It was dry.

MICHIGAN WILDCAT COMPLETIONS

Allegan County, Gange Township: Frink, Kiser & Reed 1 Studley-Hoover et al, communitized, SE NE NE 5-2n-16w, dry in Traverse, TD 1,280 ft.

Montcalm County, Ferris Township: Montcalm Development Co. 1 Pollard et al, communitized, NW NW NE 8-11n-5w, dry, TD 1,222 ft.

Sanilac County, Gremont Township: Shell Oil Co., Inc. 1 G. L. Perry, NE NE NE 9-9n-15w, dry, TD 2,364 ft.

Tuscola County, Vassar Township: E. Edward Brehm 1 Clarance Cain, SW SW SE 34-11n-8e, dry, TD 3,141 ft.

APPALACHIAN FIELD

Cross Creek Township Test Logs Onondaga High

PITTSBURGH.—In Cross Creek Township, Washington County, southwest Pennsylvania, The Texas Co. topped the Onondaga lime at 6,265 ft. in 1 J. E. McCullough farm, and the Onondaga chert followed at 6,294 ft. This places the top of the Onondaga lime at minus 4,736 ft. with an interval from the top of the Tully of 275 ft. The Onondaga section will probably extend 220 ft. It appears running regionally high compared with the nearest deep test on the J. T. McBurney farm in Mount Pleasant Township, near Hickory.

In western Pennsylvania, other wildcats have reached Devonian or Silurian markers. In Mercer County, Beal & McCandless resumed drilling on 1 J. Paul Miller, a wildcat in Lake Township, which had been standing idle for some time at 2,850 ft. It is now drilling at 3,920 ft. with the top of the Tully at 3,692 ft. and Onondaga lime at 3,860 ft.

In Warren County, Southwest Township, Northern Ordnance Co. reached 5,117 ft. in 1 Reeves with Oriskany at 4,195-208 ft. At 5,100 ft. about ½ bbl. daily of water was struck.

In Elk County, Highland Township, Pennsylvania Gas Co. has reached the Red Medina at 7,350 ft. in a wildcat on State Game lands and is now drilling at 7,416 ft.

In West Virginia, United Fuel Gas Co. drilled its test on Black Band Coal & Coke Co. in Washington district, Kanawha County, through the Oriskany sand with about 47,000 cu. ft. of gas at 4,577-83 ft. and also about 2 bbl. of oil showing

in 12 hours. It will be shot for further test.

In Union district, Kanawha County, Cumberland Gas Co. completed 9 Roymond City C. & T. Co. in the Big lime with a final gage of 3,914,000 cu. ft. of gas after acidizing.

ROCKY MOUNTAIN

Powder Wash Extension Flows 47° Gravity Oil

DENVER. — Northwestern Colorado, where an extensive wildcat play is this week when Mountain Fuel Supply Co. 3 Allen, SE SE NW 33-12n-97w, in the Powder Wash field in Moffat County, indicated it will be a big well and an important extension of that pool. In a drillstem test at 4,170-4,205 ft. it flowed through the tubing at the rate of 2,500 bbl. of 47° gravity oil per day with 4,000,000 cu. ft. of gas. It is drilling ahead. This well is an outpost ½ mile east of the same company's 2 Hal Stewart which was completed last December, making 1,505 bbl. of oil with 2,500,000 cu. ft. of gas through perforations in the casing at 4,190-4,216 ft. In addition to the show in the horizon named it cut four other sands showing oil or gas down to a total depth of 5,576 ft. The gas and oil in Powder Wash are found in the Wasatch sands of Tertiary age.

Stanolind well at Rangely. — Stanolind Oil & Gas Co. 1 Rector, NE SE 34-2n-102w, an outpost 3½ miles southeast of the Weber discovery well in the Rangely field, which at first looked like a small producer, now gives indications of being an excellent well after being thoroughly worked over. It is not yet a completion. It had the top of the Weber at 5,624 ft. and was drilled to 6,242 ft. In a swabbing test at this depth it made only 71 bbl. of oil in 11 hours, the sand being hard and tight. It was then shot with 177 quarts at 6,214-6,161 ft. and responded by swabbing 20 bbl. in 1 hour through the tubing. It was reshot with 946 quarts at 6,109-5,830 ft., after which it kicked off and flowed 126 bbl. in 2 hours, 10 minutes. It is still testing.

More wildcat locations.—Among wildcat and outpost locations this week are the following:

J. G. Dyer has made a location for 1 Dyer, SW SW NE 28-43n-91w, Lake Creek dome, Hot Springs County, Wyoming. This structure parallels the Black Mountain dome which Texas Co. recently took over, being a long, narrow anticline. It is one-third of a mile northeast of a well drilled in 1925 which had the Embar at 3,705-20 ft. and pumped 238 bbl. of 24° gravity oil per day initial. Tensleep has not been tested.

Carter Oil Co. has made a location on the McGowan dome, Fremont County, for 1 Shoshone-Arapahoe, NE SW 24-1s-1e. This is approximately the location of the old Plunkett field which has produced some light oil from the Mowry shale at a shallow depth. Deepest test drilled at McGowan went to 3,600 ft. and had the top of Sundance at 3,280 ft.

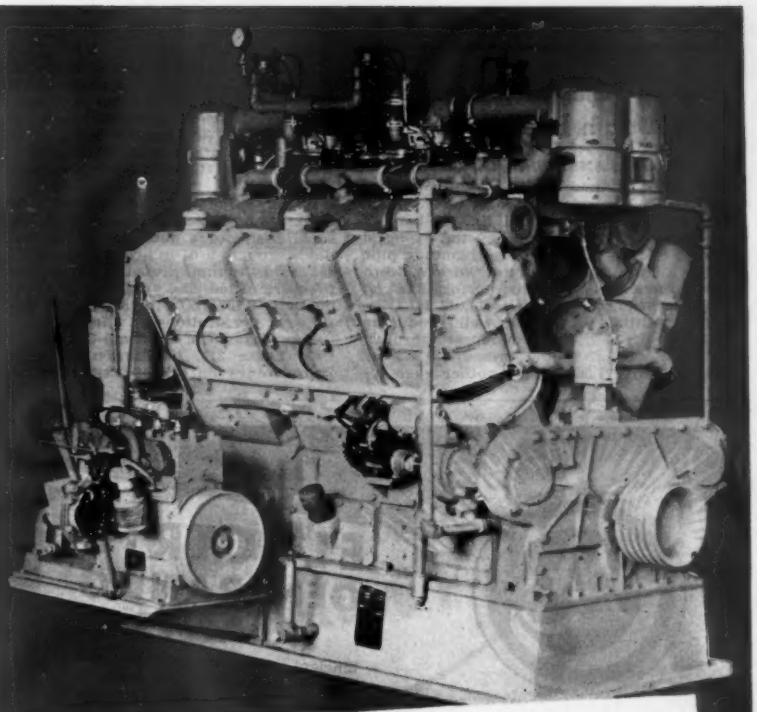
General Petroleum Corp. has made a location in Crook's Gap area for No. 72-19-P, SW NE NE 19-28n-92w. It is 1⅛ miles southeast of the Sinclair-Wyoming discovery well at Crook's Gap.

National Associated Petroleum Co. has made a location in NE 2-30n-67w, Spanish Diggings, Platte County.

WYOMING WILDCAT FAILURES

Natrona County, Boone: Stanolind 1 Unit, NW SE SW 10-35n-85w, TD 5,707 ft., core at 5,558-62 ft. in Carlile shale showed dip of 85 degrees, dry.

Big Horn County, South Byron: Continent 1 Prescott, SE SE SE 9-55n-96w, TD 6,927 ft., top Embar 6,657 ft., Tensleep 6,839 ft., Amsden 6,870 ft., dry.



LE ROI power

stays "on-the-job" dependably—
helping you to "bottom" at low cost

Here is the Le Roi RX1SV Standard Drilling Engine that has won wide-spread acclaim for its ability to perform dependably, economically, and with minimum "time-out" for service and maintenance.

There are many reasons that account for its outstanding performance record. (1) It is built by a manufacturer specializing exclusively in the heavy-duty industrial field. (2) It is designed to furnish dependable power for drilling *deep* oil wells, just as other models are designed to handle oil-well pumping and for pipe-line service. (3) It has the quality features, the precision-machined parts and accessories that give you dependable oil-field performance.

You're money ahead when you request that your rigs be powered with "Le Roi" engines. Le Roi engines are available up to 400 H.P. Use gasoline, natural gas, or butane.

Le Roi Company, 1768 S. 68th St., Milwaukee 14, Wis.

Branch and warehouse: Tulsa, Oklahoma — Branch Office: Birmingham, Alabama — Distributors — General Machine & Supply Co., Wichita Falls, Odessa, Texas • Le Roi Rix Machinery Co., Los Angeles, Calif. • Hafer Engine Service, Reed City, Mich. • Industrial Power Units, Inc., Casper, Wyo. • Carson Machine & Supply Co., Great Bend, Kansas • Southern Engine & Pump Co., Houston, Dallas, Kilgore, Alice, San Antonio, Texas • Western Machinery Co., St. Louis, Mo., Centralia, Ill.

LE ROI MILWAUKEE

SOUTH LOUISIANA

Shell's Discovery Breaks Two Depth Records

NEW ORLEANS.—Shell Oil Co., Inc., in opening the Week's Island field of Iberia Parish, set two world's records in the discovery well, the 1 Smith-State, in 13-14s-6e. Besides having the longest string of 7-in. casing ever set, landing pipe at 13,550 ft., it opened the world's deepest production, through perforations at 13,505-20 ft. Total depth is 14,023 ft. Official potential shows the well producing 112 bbl. of 40-gravity condensate through 10/64-in. choke, tubing pressure 4,365 ft., gas-oil ratio 17,589 to 1. Another gage reported had been 140 bbl. per day through 10/64-in. choke, gravity 44.9°.

Atlantic Refining Co. 1-B C. & R. Klump, in North Tepetate field, Acadia Parish, 13-7s-2w, was completed for a potential of 275 bbl. per day through 5/32-in. choke, gas-oil ratio 654 to 1, tubing pressure 1,190 lb., gravity 34.8°, no water, through perforations at 7,810-19 ft. Total depth is 8,225 ft., with 5½-in. casing set at 8,224 ft.

Union Sulphur Co. completed 3 W. O. Cook, 35-8s-4w, in Roanoke field, Jefferson Parish, for a potential of 128 bbl. per day through 9/64-in. choke, gas-oil ratio 685 to 1, tubing pressure 900 lb., casing pressure 1,150 lb., gravity 37.5°. Total depth is 8,783 ft., with 5½-in. set at 8,760 ft. with perforations at 8,700-04 ft.

The Texas Co. 71 State-Garden Island Bay, Lease 214, in Garden Island field, Plaquemines Parish, 49-23s-33e, was completed flowing 60 bbl. of 32.1-gravity oil per day through ⅛-in. choke, gas-oil ratio 324 to 1, tubing pressure 450 lb., no water. Total depth is 6,860 ft., with 7-in. casing set at 5,949 ft., and 2½-in. on packer at 5,529 ft. Perforations 5,634-64 ft.

Atlantic Refining Co. 1-E St. Mary Parish Land Co., Bayou Sale field, St. Mary Parish, 2-17s-9e, was completed at 10,290 ft., flowing a potential of 275 bbl. of oil per day through 9/64-in. choke, gas-oil ratio 863 to 1, tubing pressure 1,650 lb., gravity 35.8°. Casing was set at 10,290 ft., with 96 perforations at 10,104-12 ft., and 10,116-24 ft.

SUCCESSFUL WILDCAT COMPLETION IN SOUTH LOUISIANA

Iberia Parish: Oil discovery, Week's Island pool: Shell 1 Smith-State Lease 500, Unit 1, 13-14s-6e, total depth 14,023 ft., 7-in. casing 13,550 ft., perforations 13,505-20 ft., PT 112 bbl. day 10/64-in. choke, gas-oil ratio 17,589 to 1, tubing pressure 4,350 lb., gravity 40. This is the world's deepest producer.

WILDCAT FAILURE COMPLETED IN SOUTH LOUISIANA

Beauregard Parish: Magnolia 1-A Lutcher-Moore, 19-6s-11w, dry at 9,006 ft.

ELECTRIC GENERATING PLANTS
Efficient, compact, portable AC and DC Plants from 350 watts to 25 KW. Dependable electric current for lighting and power.
SERIES W 2 C
AC – 2000 and 3000 Watts
DC – 2500 and 3500 Watts
OIL FIELD EQUIPMENT
CMC equipment is engineered especially for portability and rugged service needed in oil field work. The CMC ELECTRIC GENERATOR LINE is built by men who pioneered the field in producing portable AC and DC Electric Generating Sets. NEW CMC PUMPS offer advanced improvements and exclusive features that set a new HIGH in Pump performance.
PUMPS
All sizes from 1½" to 10". Popular CMC 10M-OF Dual Prime Centrifugal shown above. Also Diaphragms and High Pressure Models.
ARMY E NAVY
OIL EQUIPMENT DIVISION
CONSTRUCTION MACHINERY COMPANY
WATERLOO, IOWA

SOUTHWEST TEXAS

New Pool for Goliad Co., South of Slick Field

CORPUS CHRISTI.—Transwestern Oil Co. 1 Wm. Altman estate, wildcat 15 miles north of Goliad and 2 miles south of Slick field, in the B. P. Tumlinson Survey, Goliad County, flowed 221 bbl. of oil and 10 bbl. of oil-cut water per day through 5/32-in. choke from perforations at 7,640-50 ft. Tubing pressure was 1,450 lb., casing pressure 2,500 lb., gas-oil ratio 1,442 to 1. The well was killed, the perforations squeezed, and operators are now preparing to reperforate and retest. Total depth is 8,005 ft., with 5½-in. casing at 7,775 ft.

Humble Oil & Refining Co. 1 Coward & Avant, Imogene field, Atascosa County, flowed on a 24-hour potential test 50 bbl. of oil through 3/16-in. choke, with tubing pressure of 350 lb., gas-oil ratio 2,513 to 1. The production is from open hole at 7,605-09 ft. Total depth is 7,609 ft. with 5½-in. casing set at 7,605 ft.

Continental Oil Co. 7 G. W. Allen, Slick-Wilcox field, in Goliad County, on a 24-hour potential test flowed 233 bbl. of 35.8-gravity oil, 0.1 per cent water, through 10/64-in. choke, tubing pressure 1,050 lb., casing pressure 1,600 lb., gas-oil ratio 653 to 1, from 36 perforations at 7,556-61 ft. Total depth is 7,583 ft.

Sun Oil Co. 8 A. T. Canales, Canales field, Jim Wells County, in Survey 343, on a 24-hour potential test flowed 142.07 bbl. of 42-gravity oil, no water, through 7/64-in. choke, tubing pressure 1,850 lb., casing pressure 1,925 lb., gas-oil ratio 826 to 1. Total depth is 7,228 ft. with 5½-in. casing at 7,227 ft., perforated with 12 holes at 7,223-26 ft.

Coastal Refineries, Inc. 1 Juan Solis, Garcia field, Starr County, in Tract 60, Porcion 95, on a 24-hour potential test flowed 85 bbl., no water, of 45.7-gravity oil through ⅛-in. choke, tubing pressure 525 lb., casing pressure 500 lb., gas-oil ratio 525 to 1, from 20 perforations at 3,733-38 ft. Total depth is 4,002 ft. with 5½-in. casing at 4,000 ft.

SOUTHWEST TEXAS WILDCAT FAILURES

Atascosa County: H. H. Howell 1 F. J. Jaksik, M. J. Perez Sur. 664, 3 mi. NE of Pleasanton, dry at 6,221 ft.

Guadalupe County: R. V. Muckelroy 1 Tom H. Baker, Samuel Highsmith

Sur., 3 mi. W of Luling, dry at 2,593 ft.

Jim Wells County: DeLange, Rowe & Monday Oil Co. 1 Mabel W. Luby et al, Los Presenos De Abajo Grant, 7 mi. E of Alice, dry at 5,865 ft.

Kerr County: Humble 1 W. R. Schreiner, TCRR Sur. 1677, 48 mi. NW of Kerrville, dry at 3,768 ft. To complete as water well.

McMullen County: Dee Davenport 2 Annie Graves Dolph, J. Oppenheimer Sur., 17 mi. SE of Tilden, dry at 1,943 ft.

ILLINOIS

Coles County's Best Well A Rosiclaire Producer

MATTOON.—Arthur Beckman 3 Rudy Harris (community), NW NE NE 26-12n-7e, 2 miles southwest of Mattoon, and in the Mattoon field, was showing for the largest well in Coles County by swabbing and flowing 363 bbl. of oil in 24 hours from Rosiclaire lime at 1,953-63 ft., while cleaning out.

What may prove to be a connecting link between the Rural Hill and Hoodville pools in Hamilton County is T. Blake Dirickson et al 1 W. C. Presley, SE SE SW 5-6s-6e, which was completed in Aux Vases sand at 3,095-99 ft. and 3,105-15 ft. and made 180 bbl. in 24 hours, following a 40-qt. shot.

Nineteen oil wells averaging 189 bbl. per day in initial production, and 10 dry holes, including 6 wildcats, were reported in Illinois during the week. The oil wells included a 1,250-bbl. well of Phillips Petroleum Co., 1 Kerwin, SE SE NW 21-6s-10e, in the Concord pool, White County, mentioned last week as a near completion. McClosky lime at 2,915-79 ft. and 3,021-34 ft., was acidized with 6,000 gal.

The Boyd pool, in Jefferson County, yielded next to the largest well of the week in Superior Oil Co. 1 R. Sanders et al, C W½ NE NW 19-1s-2e, which produced 700 bbl. initially from Benoist sand at 2,059-87 ft. and Aux Vases sand at 2,135-58 ft., the total depth.

The Texas Co. 3 W. E. Fretsehl, SW NW SW 24-4n-10e, Olney East pool, Richland County, flowed 435 bbl. in 24 hours from McClosky lime at 3,074-80 ft., after acid treatment.

A 281-bbl. well in the Bible Grove field in Effingham County and 234-bbl. well in the Clay City field in Wayne County completed the list of larger wells.

Only 35 new operations were reported during the week including the following wildcats: L. C. Jarvis 1 Hawkins, SE SW NE 35-1s-1e, Jefferson County; H. L. Luttrell 1 T. Aud, NE NE SE 21-6s-8e, White County; Bond County Gas Co. 1 Harwood, NW NE SW 36-7n-4w, Bond County; The Texas Co. 1 W. A. Kill, SE SE NE 3-1n-2e, Marion County; A. J. Slagter 1 Wagner, NE NW NW 5-3n-14w, and J. W. Carter 1 C. C. Borah, NW NE NW 20-2n-10e, Richland County; H. S. Williams 1 J. Norting, NW SW SW 34-1n-1w, and H. S. Williams 1 D. C. Koellinger, SE NW NW 3-1s-1w, Washington County.

ILLINOIS WILDCAT FAILURES

Clinton County: The Texas Co. 1 List, NW NE SE 21-1n-3w, dry at 1,461 ft. Tar Springs 790 ft., Cypress 1,028 ft., Benoist 1,146 ft., Aux Vases 1,206 ft., McClosky 1,375 ft.

Edwards County: Globe 1 M. E. McKinzie, SE SE NE 16-1s-10e, dry at 3,394 ft. Menard 2,449 ft., Cypress 2,971 ft. No Benoist recorded. Aux Vases 3,242 ft., McClosky 3,349 ft.

Effingham County: F. L. Strickland 1 M. Wenthe, NW SW SW 4-7n-6e, dry at 2,556 ft. Menard 1,818 ft., Cypress 2,166 ft., Benoist 2,328 ft. Aux Vases 2,374 ft., Rosiclaire 2,449 ft.

Jefferson County: Texas 1 J. P. Carson,

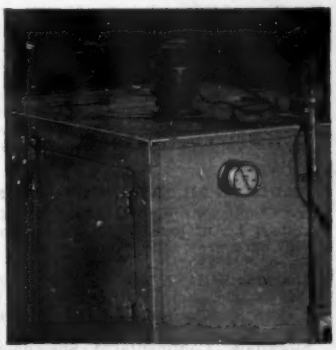
DEPENDABLE TEMPERATURE READINGS AS HIGH AS 1000°F

WESTON *All Metal* THERMOMETERS

are stable and rugged over wide temperature ranges

Here are advantages of Weston All-Metal Industrial Thermometers that provide long-term dependability for Diesel engine applications and for industrial heat control.

- WESTON all-metal temperature element has proved its stability throughout the years.
- Rugged all-metal construction resists vibration, shock and other mechanical abuse.
- Large gauge-type scales permit accurate readings even from a distance.



Weston All-Metal Industrial Thermometers are available in types and sizes for most applications, with stem lengths from 2½" to 48". Ranges + 1000° F to − 100° F. Literature sent on request . . . Weston Electrical Instrument Corporation, 673 Frelinghuysen Avenue, Newark 5, New Jersey.

Weston *All Metal* THERMOMETERS

PROTECT
Valuable Equipment
with
ADSCO
STRAINERS and SEPARATORS

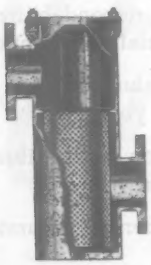
Prevent shutdowns — prolong the life of equipment—increase operating efficiency with Adsco Strainers and Separators.

THE Y TYPE STRAINER protects traps, regulators, valves and other equipment from the wearing and destructive effect of foreign matter.

THE SUCTION STRAINER does likewise for pumps and other heavier equipment where bulk liquid is contaminated with foreign matter.

ADSCO SEPARATORS
remove oil and water from steam—deliver dry steam to engines, turbines and other steam consuming equipment increasing its efficiency and protecting it from damaging water slugs.

Y TYPE STRAINER—screen held in place by removable plug that permits easy removal for cleaning—sizes from ½" to 2".



SUCTION STRAINER
Basket has handle. To clean it, simply remove cover at top and pull it out.

HORIZONTAL TYPE

VERTICAL TYPE
for either up or down flow.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, NEW YORK
Makers of UP TO DATE Steam Equipment for Over 65 Years

NW SE SE 1-4s-1e, dry at 2,983 ft. Lower Kincaid 1,764 ft., Cypress 2,486 ft., Benoist 2,660 ft., Aux Vases 2,752 ft., McClosky 2,889 ft.

Lawrence County: Parriott & Sprowle 1 W. H. Fritchie, NW NE NW 36-5n-12w, dry at 1,261 ft.

Montgomery County: Paul Doran 1 Hilton, NE SE NW 15-8n-4w, dry at 925 ft. Cypress 740 ft., Benoist 827 ft., Aux Vases 851 ft., Fredonia 920 ft.

CALIFORNIA

Shallow Tar Sands Are Receiving Development

LOS ANGELES. — The Newport-Costa Mesa district of Orange County at the southern end of the Beverly-Newport shear zone is undergoing an intensive exploratory program. Most of the current drilling is in the Costa Mesa area and development work is concentrated on two tar sands which yield wells producing small initials of low-gravity oil. In sections of the area where the productive interval is capable of yielding relatively clean oil operators will be able to develop small sustained production. To date, about 175,000 bbl. of heavy oil and asphalt have been recovered. Two tar sands have been found at relatively shallow depths. Stratigraphy of the district is extremely complicated by intrusions and a marked lack of conformity between all formations above Lower Miocene.

Probably the first wildcat to start in the northwestern states which are receiving considerable attention (see page 114, May 26 Journal) will be The Texas Co. operation at Clatskanie, Oregon, Columbia County, about 60 miles northwest of Portland on the Columbia River. Operators are preparing the location and drilling will start around the middle of June.

Los Nietos Producing & Refining Co. is progressing with its wildcat in the south dome of Kettleman Hills in 13-25s-19e, but it will be several weeks before it reaches its objective in the Eocene in event the Temblor is barren.

At Lost Hills, immediately southeast of Kettleman south dome, Standard Oil Co. of California is drilling and spot coring 58-34 Cahn, a deep test, at 9,961 ft. This test is believed to be still above the Eocene which produces at North Belridge.

Signal Oil & Gas Co. is making a test of a shallow oil sand at 2,880 ft. in 1 Needham, a wildcat in 13-3n-16w. Unless this sand proves commercially productive, drilling will be resumed as the primary objective of this well is the Modelo equivalent of the Miocene found highly productive in other Newhall-Castaic regions. In the Del Valle extension, located northwest of the original Del Valle field, The Texas Co. is nearing completion stage at 41-18 Kern. A test of a showing above the new productive zone was negative as was the case in the extension-discovery well.

WILDCAT FAILURES IN CALIFORNIA

Kern County, Antelope Hills: W. L. Hernstadt 1 Antelope, 24-27s-19e, bottomed in hard gray sand, Antelope sand barren, TD 4,003 ft.

Sharktooth: U. S. Drilling Co. 1 Garner, 25-28s-28e, bottomed in barren gray sand, Vedder sand 2,640-55 ft. barren, TD 2,695 ft.

Stockdale: Continental 1 Stockdale, 9-30s-27e, bottomed in hard gray sand, only minor showings, electric log negative, TD 8,502 ft.

Kings County, Tulare Lake: H. H. Magee 2-1 Von Glahn, 2-23s-21e, bottomed in barren gray sand, no oil showings, lower structurally than previous tests, TD 5,050 ft.

Los Angeles County: Hawthorne: L. L. Hillman, Inc. 1 West Hawthorne, 17-3s-14w, bottomed in gray sand, no cores taken, ran electric log, TD 4,602 ft.

CANADIAN FIELDS

Seventh Producer Given Conrad Field Last Week

CHATHAM.—In the Conrad field, southern Alberta, Mid-Continent-East Crest Oil Co., Ltd. 5, LSD 2, 8-6-15w4, has finished around 3,159 ft. with estimated production around 100 bbl. daily of 27° gravity crude. Water-free oil rose 400 ft. in the drill stem. This marks seven producers completed over an area ¾ mile wide and 1½ miles long, with estimated aggregate production of 900 bbl. The latest completion points to a northwest-southeast trend and a number of tests are now to be drilled on the indicated strike of the structure. Conrad-Province 51-5-A, LSD 3, 5-6-15w4, about ¾ mile southwest of Mid-Continent 5, finished 6 ft. in the Ellis sand at 3,011 ft., showed 1,040 ft. of oil in a drill-stem test, and is estimated at 150 bbl. daily.

Conrad-Province 15-35-b, LSD 9, 35-5-15w4, has spudded and Conrad-Province 15-32-B, has location in LSD 9, 32-5-15w4. Empire Petroleums 1, LSD 12, 16-6-15w4, is dry in Madison lime at 3,163 ft. after drilling a 19-ft. tight section of Ellis sand with slight traces of oil. Conrad-Province 71-4-A, LSD 4, 4-6-15w4, finished at 2,944½ ft. and is pumping 89 bbl. initial production. Conrad-Province 71-36-D, LSD 4, 36-5-16w4, is dry at 3,210 ft.

Foremost.—In the Foremost field, southern Alberta, California Standard-Foremost 3, LSD 9, 15-7-12w4, is dry at 3,263 ft. Test finished in Madison lime, with Ellis sand absent.

Steveville. — In the Steveville-Princess

LEGAL

CALL FOR BIDS. To purchase royalty crude oil accruing to the United States from the Cat Creek oil field, Montana. Pursuant to the provisions of section 36 of the Act approved February 25, 1920 (41 Stat. 451, 30 U. S. C. 192), sealed proposals, in duplicate, will be received in the Office of the Secretary of the Interior, Washington, D. C., on or before noon on June 11, 1945, from responsible bidders for the sale and purchase under contract of all royalty crude oil accruing to the United States from Federal lands in the Cat Creek oil field, Montana, commencing July 1, 1945, and extending from said date during and throughout the period of the National Emergency as declared by the President, but not to exceed a term of 2 years in any event and subject to termination by either the Government, as seller, or the successful bidder or bidders, as purchaser, upon 60 days' notice in writing if the National Emergency is declared terminated by Proclamation of the President or by Act of Congress prior to the expiration of the aforesaid 2-year period. The monthly royalty during the year 1944 averaged about 850 barrels of "light oil," or a total for the year amounting to about 10,200 barrels. The gravity of the Government's Cat Creek royalty crude oil approximates 50° A.P.I. Additional information concerning the specifications governing the sale of the Government's royalty crude oil from the Cat Creek field may be obtained from the Director, Geological Survey, U. S. Department of the Interior, Washington, 25, D. C., or the Oil and Gas Supervisor, U. S. Geological Survey, Federal Building, Casper, Wyoming. Sealed bids are to be submitted to the Secretary, Department of the Interior, Washington, 25, D. C., pursuant to the specifications, the envelope to be marked plainly, "Bid on Cat Creek royalty crude oil—not to be opened before noon, June 11, 1945." No bid received after the time fixed herein for submitting bids will be considered. Oscar L. Chapman, Assistant Secretary of the Interior.

From Oil Well to Filling Station—Strom Balls Serve the Petroleum Industry

STROM BALLS
—on the Job in Refineries

In Refinery Plants—whose products are so indispensable to the prosecution of the war—Strom Balls have repeatedly proved their worth by reducing frictional resistance in the operation of equipment such as reciprocating and centrifugal pumps, electric motors, turbine-generators and instruments. Strom Steel Ball Co., 1850 South 54th Avenue, Cicero 50, Ill.

Strom BALLS Serve Industry

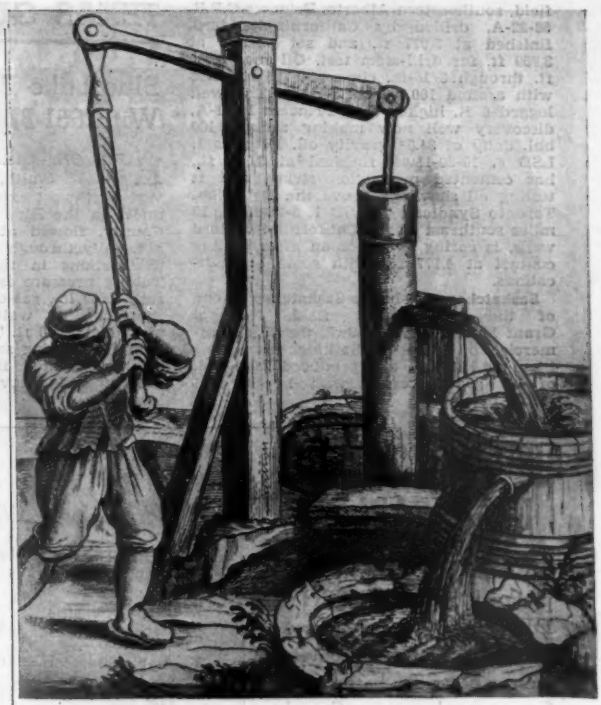
BLACK on WHITE
for
BETTER SIGHT

WYTEFACE "A" Steel Tapes have *raised* black graduations on a crack-proof white surface. Easy to read in any light, from any angle. Faster measurements with fewer errors. Designed for hard service. White background is protected by raised steel markings and rims. Resists abrasion from rails, pipe, rocks, concrete. Protected against rust. See your supply house. Write for catalog.

KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
CHICAGO • DETROIT • ST. LOUIS
SAN FRANCISCO • LOS ANGELES • MONTREAL

K+E
Drafting Reproduction Surveying Equipment and Materials Slide Rules Measuring Tapes

WYTEFACE "A"
TRADE MARK
STEEL GAUGING TAPES

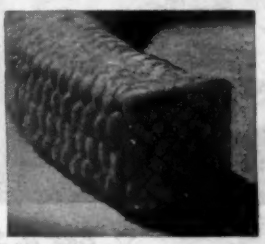


Primitive pump used on an Italian farm during the 17th Century—from a copper engraving by Athanasius Kircher, 1601-1680. Illustration from Bettmann Archive.

Primitive Pump—1650

The lift pump used by the farmers in Europe some four hundred years ago seemed to do a fairly good job according to this old-time illustration. But it's a far cry from the modern high-pressure and high-speed pumps in use today.

Pump valves, packings, gaskets and oil seals have also improved through the years—keeping pace with engineering advancements in the equipment in which they are used. Today the complete line of Garlock products fills every need of modern industry.



GARLOCK LATTICE-BRAID PACKING
The unique structural design imparts semi-automatic pressure action. Available in several styles for service on pumps and other equipment.

THE GARLOCK PACKING CO.
PALMYRA, NEW YORK
Tulsa, Okla. Houston, Tex.
Los Angeles, Calif.

Garlock

field, southeastern Alberta, Princess-C.P.R. 58-22-A, drilled by California-Standard, finished at 3,977 ft. and set packer at 3,959 ft. for drill-stem test. Oil rose 3,600 ft. through 3/16-in. choke in 109 minutes with around 100,000 cu. ft. gas. The well logged 6 ft. higher than Princess 18-21-A, discovery well now making around 100 bbl. daily of 34.5° gravity oil. Peerless 1, LSD 4, 18-20-11w4, finished at 3,184 ft., has cemented production string, and is testing oil showings above the Devonian. Toronto Syndicate 1, LSD 1, 6-22-13w4, 10 miles southeast of the California-Standard wells, is coring in Devonian after getting contact at 4,177 ft., with some oil indications.

Saskatchewan.—In the Saskatchewan end of the Lloydminster field, National Grant 1, LSD 4, 14-49-28w3, the first commercial oil well in Saskatchewan, finished at 1,890 ft., and produced 1,040 bbl. of 14° gravity crude with 1 per cent water in April.

TEXAS GULF COAST

Blue Lake Pool Extended With 651-Bbl. Producer

HOUSTON.—Glenn H. McCarthy 1 Willella W. Smith, in John Bradley Survey, northwest extension and second producer in the Blue Lake area of Brazoria County, flowed at potential rate of 651 bbl. daily through a ¼-in. choke, through perforations in the Frio at 8,651-60 ft. Tubing pressure is 1,270 lb., casing pressure 1,560 lb., gas-oil ratio 966 to 1. Gravity 36.1°, no water. Top of sand was picked at 8,650 ft. Total depth is 10,220 ft. with 7-in. casing set to 9,708 ft. McCarthy recently located five new tests in this area, and rigs have been moved on two locations.

Humble Oil & Refining Co. 5 M. E. Mayes, new producer in Mayes field, Wm. Bryan Survey, Chambers County, is completed through perforations at 8,177-80 ft. after setting screen and tubing, and flowed at potential rate of 540 bbl. per day through a ¼-in. choke, tubing pressure 910 lb., casing pressure 1,225 lb., gas-oil ratio 726 to 1, gravity 40.5°, 0.2 per cent water. Total depth is 8,230 ft., with 5½-in. casing set on bottom.

Salt Dome Oil Corp. 1 John Machycek, in Mayo field, Jackson County, flowed a potential of 78 bbl. per day of 28.8-gravity oil through ½-in. choke, through perforations at 5,124-28 ft. Tubing pressure was 350 lb., casing pressure 950 lb., with gas-oil ratio 200 to 1. Total depth is 5,657 ft., with 5½-in. casing at 5,645 ft.

Humble Oil & Refining Co. completed 3-B Woods, North Katy field, Waller County, flowing a potential of 115 bbl. daily of 42.1-gravity oil through ½-in. choke from the perforations at 6,610-11 ft. with trace of water. Tubing pressure was 750 lb., casing pressure 1,300 lb., gas-oil ratio 727 to 1. Total depth is 6,869 ft., with 5½-in. casing on bottom.

UPPER GULF COAST SUCCESSFUL WILDCAT

Colorado County: Gas-condensate discovery, Inglehart field—Shell 1 Kyle Estate, in J. Grant Sur., Abst. 233, 4 mi. N of Garwood, total depth 11,944 ft., perforations, 60 holes, at 8,780-95 ft., PT 62 bbl. day and 3,500,000 cu. ft. gas, ¼-in. choke, gas-oil ratio 51,000 to 1, tubing pressure 2,000 lb., casing pressure 150 lb., gravity 50.3°, 8 bbl. of salt water per day.

UPPER GULF COAST WILDCAT FAILURES

Brazoria County: P. H. Pewitt 1-A R. C. Storris et al, in J. E. Groce Lge. 5, 6 mi. SE of Angleton, dry at 1,173 ft.

Brazoria County: Stanolind 1 Adolph D. Suderman, HT&B Sur. 9, Chocolate Bayou area, 5 mi. SE of Alvin, dry at 12,505 ft.

Fort Bend County: Stanolind 1 Selma Jaeggli, Big Creek area, Barnabus Wickson Sur., Abst. 95, dry at 7,000 ft.

Matagorda County: The Texas Co. 4 C. G. Hamill, Wm. Baxter Sur., 9 mi. S of Sargent, dry at 7,336 ft.

Walker County: Moran Oil Co., Gar-Flo Oil Co. et al 1 Gabe Smithers, Wm. Robinson Sur., 7 mi. SW of Huntsville, dry at 7,254 ft.

Wharton County: Sun 1 Duncan et al, West Lissie area, J. Linderholm Sur., 5½ mi. SW of Lissie, dry at 10,003 ft.

MISSISSIPPI

Humble May Open New Field in Jefferson County

JACKSON.—A new field possibility in Jefferson County was seen as a result of strong gas-condensate odors encountered in cores from Humble Oil & Refining Co. 1 M. R. Smith, SE SE 12-9n-1e. With an elevation of 211 ft., top of Massive sand was reached at 9,675 ft., and odors were noted in all cores from 9,659-9,722 ft. Present total depth is 9,766 ft.

Gulf Refining Co. 1 Lees, in 32-7n-1e, Franklin County, appeared likely to extend the Cranfield pool southeast, on basis of reports that placed the Clayton chalk more than 100 ft. higher than the Placid Oil Co. 1 Crosby, dry hole to the north in 33-7n-1e.

In the Gwinville pool, Gulf 1 Gholar, 27-9n-19w, after failing in the Massive and "Mullins" sands, flowed 405 bbl. of 40° gravity oil from an upper Tuscaloosa sand at 8,570-78 ft.

In Florida, Humble's 4 Gulf Coast Realty Co. in 20-4s-30e, second well in the

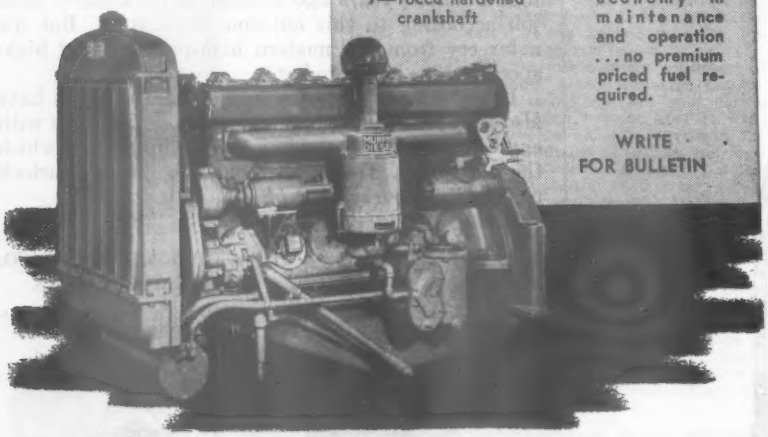
RUGGED, COMPACT, DEPENDABLE!

To make every power-job a profit-job, specify MURPHY DIESELS... for new, heavy-duty equipment, or to convert present power for better performance and economy. Sound engineering and rugged construction, relatively light weight and compactness with heavy-duty ability and long, trouble-free service life, have won MURPHY DIESELS their reputation for dependability.

MURPHY DIESEL
Outstanding Features:

1—MURPHY UNIT INJECTOR
2—24-volt electric starting
3—Ample filters for lubricating and fuel oils
4—Plain open combustion chamber
5—Copper-lead-alloy, steel-backed precision bearing shells
6—Through steel tie-bolts
7—Tocca hardened crankshaft
8—Hydraulic Servo-type governor
9—Safety control
10—Oil cooler
11—Oil cooled pistons
12—Four valves per cylinder
13—Compact, relatively light in weight
14—Heavy-duty, rugged construction, for economy in maintenance and operation ... no premium priced fuel required.

WRITE FOR BULLETIN



Murphy Diesel Model ME-6, 135 H. P. continuous, 24-hour duty, full Diesel engine.

☆ Buy U. S. War Bonds

MURPHY DIESEL COMPANY
5305 W. Burnham St., Milwaukee 14, Wis.
TULSA BRANCH: 416 S. Detroit Ave., Tulsa 3, Okla.

More Power
MURPHY DIESEL
More Profit
Engines: FROM 90 to 215 HP
Generators: FROM 60 to 115 KW
"FIELD-PROVEN Power"
106A

Sunniland district, flowed 145 bbl. of fluid, with increasing salt water content and a drop in pressure. The well was killed and a squeeze job will be attempted in open hole.

OKLAHOMA

Bromide Sand Pool Opened In Western Garvin County

OPENING of a pool in Bromide sand in Garvin County and discoveries of new pays and probable new pools made the past week in Oklahoma oil fields unusually outstanding.

Cities Service 1 Abernathy, SE SW SE 13-3n-2w, in western Garvin County, near the town of Antioch, topped Bromide sand at 5,495 ft. and a drill-stem test at 5,496½-5,502 ft. developed gas in 3 minutes and oil in 16 minutes. The well flowed through the tester for 9 minutes, with gas at the rate of 1,500,000 cu. ft. per day. The flow was estimated at about 20 bbl. per hour of oil of 41.6 gravity. Following the test the crew commenced running pipe.

In the Ramsey pool in Payne County Mid-Continent Petroleum Corp. 1 Bednar, 3 Columbia, NW NE SW 18-18n-2e, found good saturation in second Wilcox sand at 4,746-4,822 ft., which is expected to result in more deeper drilling in the pool.

Stanolind Oil & Gas Co. et al were drilling ahead in 1 Bednar, NW NW SW 23-13n-1e, east of Jones in eastern Oklahoma County, after it had shown for a pool opener in the Cleveland sand topped at 4,637 ft. A drill-stem test at 4,627½-45 ft. showed 250,000 cu. ft. of gas in 6 minutes, and a flow by heads when the tester was being pulled. The tester showed 2,280 ft. of oil and 100 ft. of oil-cut mud. The well was started as a Wilcox sand test.

The Magnolia Petroleum Co. definitely completed its discovery well in the Chitwood pool in Grady County, 1 Cunningham, C SE SE 33-5n-6w, the deepest producing well in Oklahoma. It was drilled to basal Pennsylvanian sand at 10,891 ft. and liner run to the bottom. Casing was perforated at 10,879-882 ft. On a very recent gage the well flowed 113 bbl. of distillate in 8 hours together with gas at the rate of 2,548,000 cu. ft. per day, through a ¼-in. choke. Magnolia has about 5,000 acres thereabouts, but has not announced plans for further development.

Eight wells were completed during the week in the West Edmond field, bringing the number of Hunton lime wells in the pool to 527. The total production of the pool up to Saturday was about 16,848,000 bbl.

OKLAHOMA SUCCESSFUL WILDCATS

Carter County: New oil pool—Continental 1 Dotson, SW NW NE 7-2s-3w, pumped 37 bbl. in 7½ hours, gravity 32.5°, from sand at 6,356-6,487 ft., TD 6,487 ft.

Kingfisher County: Extension to West Edmond pool — Anderson - Prichard 1 Stewart, NW NW 24-15n-5w, flowed 141 bbl. in 22 hours through 8/64-in. choke from Hunton at 7,014-26 ft., TD 7,293 ft., Hunton 6,984 ft., Harragan 7,026 ft., Chimney Hill 7,119 ft., Sylvan 7,278 ft.

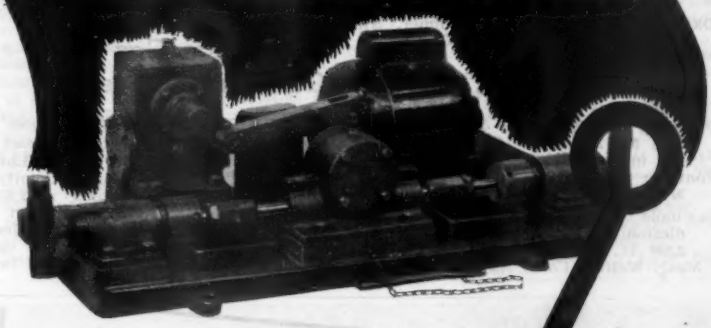
Pawnee County: New oil pool—Westgate-Greenland 1 Orten, NW NW SE 33-22n-5e, OWWO wildcat discovery, OTD 3,217 ft., PB 3,150 ft., pumped 25 bbl. per day from Bartlesville at 3,109-50 ft.

OKLAHOMA WILDCAT FAILURES

Cleveland County: Kerlyn and Phillips 1 Burnett (Eugenia), SW SE NW 19-6n-1e, dry, TD 6,960 ft., Wilcox 6,872 ft.

Creek County: A. D. Spears et al 1 Sowards (Terry), NW SE SW 19-15n-7e, dry, TD 4,206 ft., second Wilcox 4,192 ft.

For *LABORATORY* and Production Service

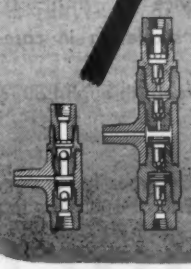


HILLS-McCANNA *Type "U"* Proportioning Pumps

• The Type "U" pump was specially developed to meet requirements for high pressure, small capacity proportioning in experimental laboratories, liquid catalyst feeding, pilot plant work, acid and caustic injection, etc. It is available in 45 models with a range including 1.2 G.P.H. working against 4800 P.S.I. up to 31.2 G.P.H. at 190 P.S.I. The time-proved rack and pinion drive operates in a special oil filled housing. Rapid variation in volume is provided by a calibrated sleeve type adjustment.

This is only one of a complete line of proportioning pumps specially designed for a given type of service. They are the quality leaders. Write for CATALOG P-44 and outline your requirements.

HILLS-McCANNA COMPANY
2351 West Nelson Street • Chicago 18, Illinois



CHECK VALVES

Vertical composite check valves used with Type "U" pumps incorporate suction and discharge in the same body. Available in ball or cone types with single or double checks.

HILLS-McCANNA
Precision **PROPORTIONING PUMPS**
Proportioning Pumps — Force Feed Lubricators — Chemical Valves — Air & Water Valves — Marine Valves — Magnesium Alloy Castings

Garvin County: Helmerich & Payne 1 Keele, NE NE NE 22-1n-1w, dry, TD 2,508 ft., in limy sand.

Kiowa County: Amerada 1 Wiede, SW NE NE 31-7n-16w, dry, TD 1,025 ft., Sylvan 1,018 ft.

Logan County: Texas 1 Hoge, SE SE NW 8-16n-3w, dry, TD 6,431 ft., second Wilcox 6,397 ft.

Okfuskee County: Texas 1 Palmer, SW SW NE 33-11n-10e, dry, TD 3,531 ft., Pitkin 3,470 ft.

Westgate-Greenland 1 Fitch, SE NE NW 34-10n-10e, dry, TD 3,370 ft., Cromwell 3,308 ft.

Pittsburg County: Public Service 1 Bell, W½ NE NW 17-7n-14e, dry, TD 2,127 ft., in sand.

Pontotoc County: Bonifield 1-A Johnson, NW SW SE 9-3n-7e, dry, TD 310 ft.

Seminole County: Sam Jewell 1 Huddleston, NE NE SE 31-6n-6e, dry, TD 2,386 ft., in sand.

Mealy-Wolfe 1 Cone, NE NE SW 11-7n-5e, dry, TD 3,400 ft., Earlsboro 3,350 ft.

Stephens County: Ashland Oil & Refining 1 Harley, SW NW SW 3-2s-7w, dry, TD 5,540 ft., Arbuckle 5,500 ft.

OHIO, KENTUCKY

La Grange Gas Pool Gets East Extension

COLUMBUS.—The La Grange pool was extended ½ mile to the east by Hanley & Bird 1 R. E. Walker, Lot 76, La Grange Township, Lorain County. A thickening sand was logged at 2,363-82 ft. and gaged 3,465,000 cu. ft. In the same area the Ohio Fuel Gas Co. 1 George S. Waite, Lot 157, extended the upper Wellington pool over into Pittsfield Township. The Clinton sand at 2,251-58 ft. gaged 1,040,000 cu. ft. with a rock pressure of 1,125 lb.

The Ohio Fuel encountered gas in the Ohio shale while drilling a Clinton wildcat on the Harker tract, Section 22, Deerfield Township, Morgan County. First gas at 1,917 ft. increased to 3,320,000 cu. ft. at 1,932 ft. The well will be turned into the line for a few days before completing.

OHIO WILDCAT FAILURES

Medina County, Guilford Township: Ohio Fuel Gas 1 Wm. Leahr, Sec. 12, Clinton 3,249-54 ft., dry, TD 3,342 ft.

Homer Township: Wm. Dempsey 1 W. J. Loufman, Sec. 12, Clinton, no sand, dry, TD 2,874 ft.

EASTERN KENTUCKY

ASHLAND.—Completion of one gas well, a dry hole and partial progress in oil on an original gas drilling, constituted the activities in the eastern Kentucky field during the week.

Kentucky-West Virginia Gas Co. completed No. 5,540 on the Freeman Williamson land on John's Creek in Pike County, at a total depth of 3,237 ft., with a daily open flow of 37,000 cu. ft. of gas in shale and 133,000 cu. ft. of gas in the Big Lime.

Kentucky-West Virginia Gas Co. completed No. 5,569 on the Hawk Collins land on Tom's Branch of Buffalo Creek in Floyd County, at a total depth of 2,930 ft. as a dry hole.

The Virginia Gasoline & Oil Co. began operations on No. 1 on the Freeland Preece land, drilling for gas, but struck oil at 70 ft. Further progress was not reported.

WESTERN KENTUCKY

OWENSBORO.—Ashland Oil & Refining Co. 1 Verona Coal Co., 6 miles northeast of Morganfield and 1½ miles north of Waverly, Union County, a wildcat, was completed in Cypress sand at 2,283-87 ft. and still in the sand. It produced about 130 bbl. in 12 hours while pumping equipment was being installed and is believed to be good for between 200 and 300 bbl. per day. It is 1½ miles from production in the Hitesville pool. Another wildcat success in western Kentucky is Fleming & Swann 1 Patterson, 2 miles east of Corydon, which pumped 120 bbl. initially from Cypress sand at 2,265-72 ft.

A wildcat "near completion" is Sallee Bros. and J. W. Carter 1 Liles, 1 mile south of Dixie, Henderson County, and

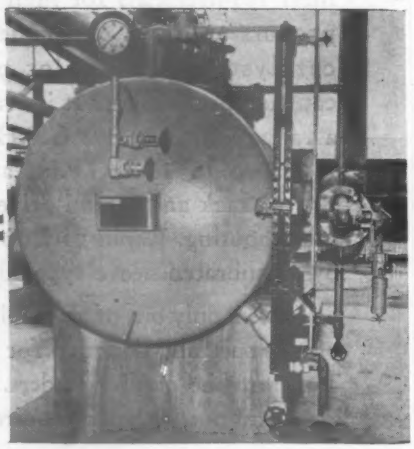
LEGAL

OIL AND GAS LEASE

UNITED STATES DEPARTMENT OF AGRICULTURE, Forest Service, Columbus 16, Ohio, May 21, 1945. Sealed bids in triplicate will be received until 2:00 P. M. Eastern War Time June 25, 1945, and then publicly opened, offering bonus for operating rights in connection with gas and oil leases on land located in the State of Ohio, Muskingum County. Separate bids will be received and separate leases issued on each of the three descriptions as follows: Block 4—(234.24 acres, more or less: W½ NW¼ Sec. 34, containing 79.23 acres, more or less, and part S½ SE¼ NW¼ Sec. 34, containing 19.94 acres, more or less; part E½ SW¼ Sec. 34, containing 60.94 acres, more or less; and part SE¼ Sec. 34, containing 74.13 acres, more or less, all in T 13 N, R 12 W. Block 3—(108.57 acres, more or less): Part NW¼ SE¼ Sec. 15, containing 28.77 acres, more or less; part SE¼ Sec. 27, containing 28.86 acres, more or less; part NE¼ Sec. 34, containing 48.19 acres, more or less; and part NE¼ Sec. 34, containing 2.75 acres, more or less; all in T 13 N, R 12 W. Block 6—(192.05 acres, more or less); Part W½ Sec. 27, containing 187.33 acres, more or less; and part NW¼ SE¼ Sec. 27, containing 4.72 acres, more or less; all in T 13 N, R 12 W. Award will be made only to bidder who can show sufficient experience and financial resources and prove citizenship. Interested parties may obtain bid documents, lease forms, and operating regulations from the Forest Supervisor, U. S. Forest Service, New Federal Building, Columbus 16, Ohio.

INDOORS—OUTDOORS

Tanks with JERGUSON Gages are Equipped with DURABLE Gages



J JERGUSON

● Durability as well as visibility is needed in liquid level gages for they are subject to destruction from four elements: pressure, temperature, corrosion and external violence.

Durability of JERGUSON Reflex and Transparent Gages results in part from:

A . . . steel or alloy parts, depending upon service

B . . . scientifically tempered glass to prevent shattering in case of sudden temperature changes or blows

C . . . U-bolt construction for Reflex Gages; strong through-bolt construction for Transparent Gages

D . . . mica-protected glass for use with steam

Standard JERGUSON Gages are designed in Reflex Types for use under pressure up to 3200 pounds at 100° F. or up to 1200 at 1000° F. In the Transparent Type they are designed for pressures up to 2000 at 100° F. and up to 600 lbs. at 1000° F. Special gages are available for more severe services. Also jacketed gages.

JERGUSON GAGE & VALVE CO.

85 Fellsway Somerville 45, Mass.

the discovery well of what may be called the Dixie pool. It has Cypress sand at 2,289-2,301 ft. and on a pumping test produced 181 bbl. of oil and about 30 bbl. of water.

WESTERN KENTUCKY SUCCESSFUL WILDCATS

Henderson County: F. Fleming and A. K. Swann 1 Patterson, SE¼ 1-O-22, Cypress sand 2,265-72 ft. TD., IP 120 bbl. oil, 30 bbl. water.

Union County: Ashland 1 Verona Coal Co., 7-O-21, Cypress sand 2,283-87 ft. TD, pumped 130 bbl. without a shot, with the pump set at slowest stroke to prevent water encroachment.

Daviess County: A. J. Slagter et al 1 Rose Hollis, 9-Q-30, Waltersburg sand 1,774-84 ft. TD, shot with 30 qt., but no gage was obtainable.

INDIANA

EVANSVILLE, Ind. — Chester Oil Co. completed the only good well reported in Indiana in the past week. It was 7 George Shoultz, NE NE SE 17-1s-9w, Wheeling pool, Gibson County, which started at 348 bbl. in 18 hours from Waltersburg sand at 1,053-62 ft. No wildcat completions were reported.

KANSAS

Sumner County Gets New Simpson Pool

CARTER OIL CO. 1 Latimer, NW NE 12-33n-2w, in Sumner County, about 7 miles southeast of the Wellington pool, swabbed 170 bbl. of oil and 32 bbl. of water in 23 hours from the Simpson sand at 4,270-82 ft., opening a new pool in the Caldwell, Wellington, Zyba trend. Tops reported are Kansas City 3,209 ft., Mississippi lime 3,862 ft., Kinderhook 4,200 ft., Simpson sand 4,268 ft.

Barber County.—Attempts still continue to locate large Viola production in this country, but Cities Service 1 Smith, SE SE SE 24-20-13w, 3 miles east of J. M. Huber's recent oil discovery, is apparently a failure. After drilling 25 ft. into the Arbuckle, topped at 4,706 ft., and finding nothing, both the Viola and Mississippi proved disappointing on tests.

Aladdin & Landon 1 House, SE SE NW 22-30s-12w, in this area is drilling at 4,516 ft., with Kansas City top reported at 3,810 ft., and Mississippi lime at 4,318 ft.

Kiowa County.—Stanolind Oil & Gas Co. 1 Zantz, SW SW SW 29-29s-18w, is preparing to make drill-stem test at 5,342-49 ft. in Simpson, after finding nothing in Lansing, Mississippi, or Viola.

KANSAS SUCCESSFUL WILDCAT

Saline County: Extension to Salina pool—Westgate-Greenland 1 Prescott, NW SE SW 17-14-2w, physical potential of 245 bbl. per day from Viola at 3,238-53 ft., TD 3,484 ft., Viola 3,238 ft., Simpson 3,366 ft., Arbuckle 3,443 ft.

KANSAS WILDCAT FAILURES

Barton County: Champlin & Koch 1 Tuggle, NE SW NW 28-20-14w, dry, TD 3,626 ft., Arbuckle 3,602 ft.

Comanche County: United Carbon 1 Boisseau, SE NW 27-31-18w, dry, TD 6,000 ft., Arbuckle 5,966 ft.

Gray County: Texas 1 Seal, NW NW NW 9-24-27w, dry, TD 5,550 ft., Arbuckle 5,402 ft.

Kingman County: B & R Drilling 1 Theis, NE NE 13-29-10w, dry, TD 4,733 ft., Arbuckle 4,700 ft.

Lane County: Skelly Oil Co. 1 Fagerquist, NE NE SW 22-18-30w, dry, TD 5,015 ft., Arbuckle 4,983 ft.

Ness County: Transwestern Oil 1 Cornelsen, SW SW NW 29-18-21w, dry, TD 4,670 ft., Arbuckle 4,565 ft.

Stafford County: W. P. Faulkner 1 Faushier, NW NW NW 25-21-13w, dry, TD 3,742 ft., Arbuckle 3,696 ft.

Sumner County: Barnsdall 1 Hare, NE

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the SE¼ sec. 18, T. 26 S., R. 26 E., M.D.M., California, 160 acres within the known geologic structure of the Kern River Field, is offered to the responsible qualified bidder of the highest cash bonus per acre for lease under section 17 of the mineral leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U.S.C. 226). Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington 25, D. C., up to 12 noon, June 18, 1945. Each bidder must submit a certified check or cash for one-fifth of the amount bid, payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease required by section 7 of Circular No. 1386. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bid by the Secretary of the Interior. The envelopes should be plainly marked "Bid for lease in Kern River Field, California. Not to be opened before noon, June 18, 1945." No bid received after the time fixed herein for submitting bids will be considered. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U.S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

Little Troubles Can't Harm This Engine

● When your engines are equipped with PENN Safety Controls, you don't run the risk of major breakdowns caused by little troubles in lubricating and cooling systems. Why? Because whenever oil pressure fails or jacket water temperature rises too high, PENN Safety Controls go into action . . . *sounding an alarm, flashing a light or shutting down engine operation.* Consequently, these relatively little troubles are discovered and can be corrected . . . before there is serious damage or long operation delay.

Easily installed on any internal combustion engine . . . PENN Safety Controls are built in three basic models: oil pressure only, water temperature only and the combination type.

Investigate this low-cost protection for your engines; write *Penn Electric Switch Co., Goshen, Ind.* Export Division: 13 E. 40th Street, New York 16, New York, U. S. A. In Canada: Powerlite Devices, Ltd., Toronto, Ontario.

TYPICAL FUNCTIONS OF PENN SAFETY CONTROLS

Diesel Applications. Sounds an alarm only . . . closes magnetic fuel valve and sounds alarm . . . closes magnetic fuel valve only . . . closes magnetic fuel valve and opens pilot relay.

Battery Ignition Applications. Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

Magneto Ignition Applications. Sounds an alarm only . . . grounds dual magneto . . . grounds magneto only . . . grounds magneto and sounds an alarm or lights a signal light.

Dual Ignition Applications. Opens battery circuit and grounds magneto.

Penn Combination Pressure and Temperature Control

PENN

AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, ENGINES, PUMPS AND AIR COMPRESSORS

Designed Specifically for OIL *and* GAS SERVICE

Kennedy Valves for the oil and gas industry are of particularly rugged construction for the requirements of refineries, oil and gas fields, pump houses, and high pressure oil or water pipe lines.

These valves are fully described in the 240-page catalog of Kennedy Valves, Pipe Fittings and Fire Hydrants, which will be sent on request.

THE KENNEDY VALVE MFG. CO.
ELMIRA, N. Y.

KENNEDY

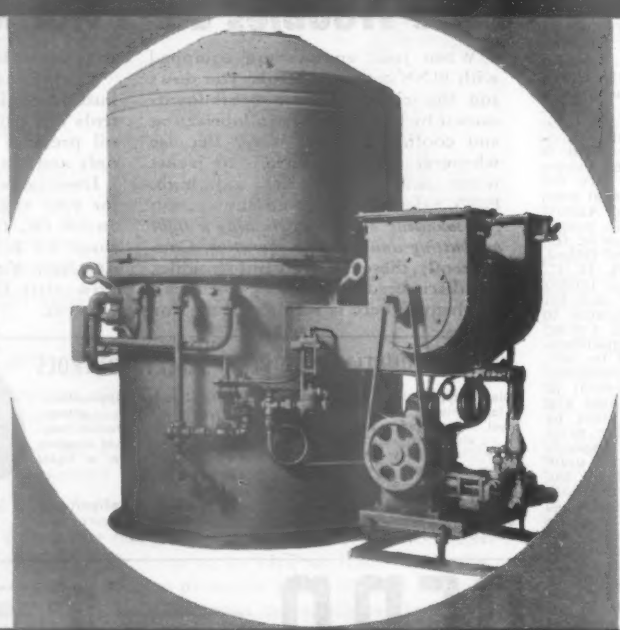
Extra Values in VALVES and PIPE FITTINGS

BETTIS STEAMERS FOR PORTABLE STEAM

Bettis Steamers are especially designed to provide instant portable steam for every oil field need. Simple, compact and rugged, they are safe, easy to operate and economical to maintain.

More than 200 units throughout the oil country are supplying abundant quantities of low-cost steam, when and where it is needed, for various purposes such as: cleaning paraffin lines, tank bottoms . . . heating and treating oil . . . stripping paint . . . exhausting gases . . . heating power rigs, camps . . . distilling drinking water . . . or any job where quick and portable steam is required.

Outstanding features are: full steam pressure in 2 minutes . . . low fuel consumption attaining approximately 80% efficiency . . . burns No. 3, or better fuel oil . . . fuel and air intakes above zone of inflammable gases . . . operating pressures regulatable from 75 lbs. to 300 lbs. . . . light weight for easy handling. All units meet A.S.M.E. and established regulations.



Bettis Steamers employ a patented staggered coil assembly, compensated for expansion, and designed to split into narrow films combustion gases which flow freely in opposite direction from the flow of water through the coils—insuring maximum efficiency.

A single motor operates feed-water pump, fuel pump, magneto for ignition, and blower for combustion air. Thus, fuel supplied to burner is automatically regulated in relation to amount of water circulated and amount of air delivered for combustion. Gasoline engine can be substituted where electric current is not available.

Only small power units (either electric or gasoline) are required in proportion to the capacities of the steamers, making possible a distinct economy in cost of operation.

Bettis Steamers are available in 10, 30 and 80 horsepower (illustrated) sizes.

Further information and prices on request.

BETTIS SALES COMPANY

1507 MAURY ST., HOUSTON 10, TEXAS, U. S. A.

WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended May 26, 1945					Cumulative total, 1945				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	0	0	0	2	2	0	0	7	27	34
Indiana	0	0	0	0	0	2	0	0	7	9
Illinois	0	0	0	6	6	17	0	0	99	116
Kentucky	3	0	0	0	3	7	0	1	14	22
Michigan	0	0	0	4	4	3	0	1	100	104
Kansas	1	0	0	8	9	17	0	8	129	154
Neb., Mo., Iowa	0	0	0	0	0	0	0	0	9	9
Oklahoma	3	0	0	12	15	43	0	6	125	174
Texas:										
North Central	0	0	0	5	5	37	0	4	186	227
West	1	0	0	3	4	25	0	0	118	143
Panhandle	0	0	0	0	0	0	0	1	4	5
Eastern	0	0	0	0	0	5	2	0	34	41
Gulf Coast	0	1	0	7	8	26	2	13	103	144
Southwest	0	0	0	4	4	9	1	3	68	81
Total Texas	1	1	0	19	21	102	5	21	513	641
Louisiana:										
Northern	0	0	0	1	1	1	1	2	27	31
Southern	1	0	0	1	2	13	0	0	19	32
Total Louisiana	1	0	0	2	3	14	1	2	46	63
Arkansas	0	0	0	1	1	0	0	0	22	22
Mississippi	0	0	0	0	0	3	0	0	46	49
Ala., Ga., Florida	0	0	0	0	0	0	0	1	10	11
Montana	0	0	0	0	0	6	0	0	9	15
Wyoming	0	0	0	2	2	8	0	0	17	25
Colorado-Utah	0	0	0	0	0	0	0	0	3	3
New Mexico	0	0	0	0	0	6	0	2	25	33
California	0	0	0	5	5	1	0	2	80	83
Total United States	9	1	0	61	71	229	6	51	1,281	1,567
Total previous week	16	0	4	65	85					

NE NE 13-31-3w, dry, TD 4,450 ft., Arbuckle 4,395 ft.

FOREST CITY BASIN

ST. JOSEPH, Mo.—R. S. Tomer Production Co. 1 A. E. Knisely, NE NW NW 10-1s-15e, Brown County, Kansas, fourth operation in the Morrill pool, was drilling at 1,790 ft. This is 1,320 ft. south of 1-A Livengood, third operation, which has been put on pump.

Fell & Reid No. 1 Fred Klam, C SE SE SE 19-51n-33w, Platte County, Missouri, northeast of Parkville, topped St. Peter sand at 1,630 ft. and Arbuckle lime at 1,714 ft. At 1,741 ft. there was a slight showing of gas.

Claude McQueen started 1 Mary Meyers, CE NE SW 13-63n-41w, Atchison County Missouri, near Corning. At about 400 ft. there was a twistoff and the small portable rotary was moved over for another start.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that lot 16, sec. 23, T. 4 N., R. 92 W., 6th P.M., Colorado, 8.28 acres in the Iles oil field, is offered to the responsible qualified bidder of the highest cash bonus per acre for lease under sec. 17 of the mineral leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U. S. C. 226). Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington 25, D. C., up to 12 noon, June 20, 1945. Each bidder must submit a certified check or cash for one-fifth of the amount bid, payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease required by section 7 of Circular No. 1386. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bid by the Secretary of the Interior. The envelopes should be plainly marked "Bid for lease in Iles oil field, Colorado. Not to be opened before noon, June 20, 1945." No bid received after the time fixed herein for submitting bids will be considered. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color or natural origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

LA.-ARK.

Bienville Parish Gets New Oil Pool

SHREVEPORT.—Bienville Parish has a new oil pool, as Ohio Oil Co. 1 Walker, in 31-17n-7w, near Sailes, flowed 232 bbl. through a ¼-in. choke from the Pettit lime, through perforations at 6,799-6,817 ft. and 6,829-56 ft.

Jackson Parish.—Shell Oil Co., Inc., 1 Tremont Lumber Co., gas discovery in NW SE 22-15n-1w, near Chatham, made 8,000,000 cu. ft. of gas per day from perforations at 9,564-9,620 ft.

Richland Parish.—The Delhi pool had one oil well and one dry hole completed with another prospective producer testing. C. H. Murphy and Sun Oil Co. 2-C Holt, SW SE 21-17n-9e, was completed for 280 bbl., from Tuscaloosa sand at 3,276-86 ft., while same operators' 1 McEacharn, NW SE 22-17n-9e, was dry at 3,583 ft. Gulf Refining Co. 1 Baughman, NE NW 28-17n-9e, on test, made 41 bbl. of oil in 4 hours from pay at 3,314-33 ft.

Webster Parish.—Ohio Oil Co. et al 1 Pardee Account, a deep Cotton Valley well in 36-22n-10w, was completed for 398 bbl. of condensate in the Bodcaw sand.

NORTH LOUISIANA WILDCAT FAILURE

Caldwell Parish: Atlantic Refining 1-C Louisiana Central Lumber Co., NE NW NE 14-12n-3e, dry, TD 3,885 ft.

ARKANSAS WILDCAT FAILURE

Chicot County: Lisbon Gasoline 1 Thudium, 2,920 ft. south and 1,030 ft. east of NW cor. 9-15s-2w, dry, TD 4,614 ft.

MARKET QUOTATIONS

Prices as of May 29, 1945

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.)	76†	70-74
Mid-Continent*	6.75	5.875
Gulf Coast	6.75	5.625
Northeast Coast	...	9.075
California	...	6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	25-70	10-55
Oklahoma (Group 3)	4.500	5.400
North Texas (f.o.b. plant)	4.125	4.950
North Louisiana (f.o.b. plant)	4.375	5.250
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.18
Illinois Basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.08

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.19	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended May 19, 1945
(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Distillate	Residual
East Coast	715	13,601	6,195	5,818
Appalachian	184	3,775	429	332
Ill., Ind., Ky.	801	21,770	3,950	1,805
Okla., Kan., Mo.	403	9,285	1,837	1,152
Inland Texas	255	2,939	320	825
Tex. Gulf Coast	1,176	13,950	6,111	5,947
La. Gulf Coast	248	4,583	1,555	1,436
North La., Ark.	84	2,788	662	202
Rocky Mtn.	117	2,461	298	624
California	945	14,521	8,113	20,483
Total 5-19-45	4,908	*89,673	29,470	38,624
Total 5-12-45	4,850	89,950	28,996	38,948
Total 5-20-44	4,513	87,785	31,104	50,761

*Military 41,309, Civilian 48,364.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
May 19, 1945	221,861,000
May 12, 1945	221,598,000
May 20, 1944	234,299,000

*Excludes unrefinable California stocks.

ON WORK-OVERS
and for DRILLING-IN
Use
BJ
COMBINATION HOOKS

★ Hook has a soft spring with a full 5 inch travel.
★ It is made both with and without swivel locks as required.
★ Designed for direct connection to popular make traveling blocks.
★ Capacities from fifty to seventy-five tons.
★ Safety factor: 4 to 1.

Ask the BJ supplier.

BYRON JACKSON CO.
Houston • LOS ANGELES • New York

Among the Drilling Contractors

Bilbo & Redding is the firm name of a drilling-contracting organization which has been established in Houston. Both men are well known in Gulf Coast fields. Porter Bilbo worked for the Portable Rig Division

PORTER BILBO

JOE REDDING

of Texas Iron Works, Houston, for 19 years. At the time he resigned to enter the drilling contracting business, he was assistant general manager. Joe Redding was superintendent of drilling and production for Texas Gulf Producing Co. He had been with the company for 16 years, during which he has worked throughout the Gulf Coast and Southwest Texas areas. Headquarters for the new concern are at 3805 Jensen Drive.

Ralph M. Parsons Co., successor to Bender Drilling Co., has been awarded contract for the 44-3 Portals, to be drilled in the Race Track field for British American Oil Producing Co., discoverer of the field north of the Edison field in Kern County, California. The new well will be drilled in about the center of Section 3-30s-29e, and will be spudded upon completion of 21-3 Portals in the same section.

Buaas Drilling Co. will soon start moving in drilling equipment to be used in the drilling of a new well for Los Angeles Basin Oil Co., to be located in Section 2-19s-15e, at Coalinga.

C. E. Ash is the contractor on the Inland Oil Co. 1 Arnold, which was drilling below 970 ft. in SW SW SE 8-19-15w, Barton County, Kansas.

Simpson & Noble Drilling Co. has staked a new wildcat location at the 1 Oliver, in NW NW SW 9-15-11w, Russell County, Kansas. Location is 3 miles northeast of the Dubuque pool production. Vickers Petroleum Co. is contributing dry-hole money to the test.

W. B. Campbell, Great Bend, Kans., has been awarded drilling contract on the W. P. Faulkner 1 County Farm Center, in NW NW NW 16-21-16w, a Pawnee County wildcat. Location is approximately

WORTH WAITING FOR
BUT NO WAITING
IS NECESSARY

'BESTOLIFE—the Lead Seal Joint Compound used successfully in the Drilling and Refining Industries for years—is immediately available through more than 100 distributors in the U.S.A. Any priority rating will do.

Your nearest supply house field store probably has 'BESTOLIFE in stock for immediate delivery. Use 'BESTOLIFE—it's BETTER!

EXPORT: THE NATIONAL SUPPLY CORP., 30 ROCKEFELLER PLAZA, NEW YORK

I. H. GRANCELL
1601 EAST NADEAU STREET
LOS ANGELES 1, CALIFORNIA

LET ME SHOW YOU WHAT GOOD WATER CONDITIONING SERVICE REALLY IS!
Call JOHN FIELD-MAN ON YOUR NEXT WATER CONDITIONING JOB
LELAND HAMNER CO.

LELAND HAMNER CO.
P. O. Box 1065 · Capitol 9758 · Long Distance LD 2175
2211 PRESTON AVE., HOUSTON, TEXAS

Electrode Holder Gives
Performance Plus

Saves on Rods
Works Cooler
Keeps Down Maintenance
Small, Light, Streamlined

Distributors in principal cities
Martin Wells
5886 Compton Ave., Los Angeles 1, Calif.

2 miles north of Larned, and 5 miles southwest of production in the Pawnee Rock pool.

John A. Mulcahy Drilling Co. with offices in Bakersfield, Calif., has articles of copartnership and certificates of fictitions firm names in Kern County, California, as required by state law. John A. Mulcahy is listed as a general partner and E. A. Bender and Clyde C. Hall as limited partners. All three are experienced contract drillers.

Hall and Miller are contractors on the W. J. Marten, F. C. Hall and Joe J. Miller 1 Payne, in NE NE NW 20-6n-7e, in the Sasakwa area of southeastern Seminole County, Oklahoma. Amerada Petroleum Corp. and Transwestern Oil Co. are contributing dry-hole support.

Keys Drilling Co. has the drilling contract on the W. L. Hartman 1 Pillar, in SW SW NE 8-20-13w, Barton County, Kansas. The test is located 1 mile northeast of production in the Harrison pool and 4 miles east of the Hiss pool production.

Don Ingling is the contractor, and has part interest in the Mid-States et al 1 Ross, which was drilling below 2,200 ft. in SE SE SW 25-12-15w, Russell County, Kansas. The test is approximately 3 miles northwest of the Derby Oil Co. 1 Rogg, in SE SE SW 7-13-14w.

Gordon Oil Co. will drill two tests in Michigan, one in Gratiot County, for National Associated Petroleum Co., and the other in Mecosta County, for Michigan Consolidated Gas Co. The former is the 1 R. Barnhart, in 5-9n-1w, and the latter is the 1 John Care-State, in C SE 31-16n-9w.

R. & S. Drilling Co. is contractor on the Sohio Petroleum Co. 3 Gas Unit Communitized, in C SW 28-16n-6w, Isabella County, Michigan.

CALENDAR

June

American Gas Association Southwest Personnel Conference, ninth meeting, Washington - Youree Hotel, Shreveport, June 5.

American Gas Association Midwest Personnel Conference, Phillips Hotel, Kansas City, June 7.

Interstate Oil Compact Commission, executive committee meeting, Oklahoma City, June 15-16.

Canadian Gas Association, annual convention, Manoir Richelieu Hotel, Murray Bay, Quebec, June 19-22.

October

Texas Mid-Continent Oil and Gas Association, Rice Hotel, Houston, October 4-6.

I.P.A.A., annual membership meeting, Tulsa, October 15, 16 and 17.

McCORD "CLEARSITE" SIGHT FEED

McCord "Clearsite" plastic sight feeds provide a new degree of visibility and clearness, supplying positive proof of oil delivery. Due to its design this sight feed may be used as an independent sight at point of lubrication. As an accessory it can be added to any lubrication system. Specify "Clearsite."

McCORD "SF" LIQUID SIGHT FEED LUBRICATORS

A highly developed lubricator, particularly adapted to cylinder and bearing lubrication. Features: Precision built, most flexible and positive oil delivery system known. Supplied in 1 to 24 feeds. Specify McCord "SF" Lubricator.

For Sale by National Supply Co.

McCORD RADIATOR & MFG. CO. DETROIT, MICHIGAN LUBRICATOR DIVISION

HOW TO MAKE A LITTLE STEEL GO A LONG WAY

A 2", 6000 lb. test, ring joint flanged union weighs 54 lbs. . . . enough steel to make nearly five 2", 6000 lbs. test, UNIBOLT Couplings! And UNIBOLT Couplings have a higher safety factor.

UNIBOLT (TRADE MARK REGISTERED U. S. PATENT OFFICE) THE ONE BOLT COUPLING

THORNHILL-CRAVER COMPANY • HOUSTON

William M. Barret, Inc.

Consulting Geophysicists

Specializing in Magnetic Surveys

Contracts accepted for domestic and foreign projects, using the most improved instrumental and interpretative technique.

GIDDENS-LANE BUILDING SHREVEPORT, LA.

PENBERTHY "REFLEX" WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO. DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

EIGHT interchangeable cutters. Fast cutting action, directed at 30 degree angle, cutters are hard surfaced steel. See Composite Catalog or write for Bulletin and additional information.

UNIVERSAL ENGINEERING CO. OFFICE AND FACTORY 2369 EAST 51st ST. • LOS ANGELES 11, CALIFORNIA BRANCHES: HOUSTON, TEXAS • LAKE CHARLES, LA. BAKERSFIELD VENTURA AND AVENAL, CALIFORNIA

PERSONALS

They Called Him "One-a-Day" Toussaint

THEY called him "One-a-Day" Toussaint because drilling operations for Standard Oil Co. of California under his supervision completed an average of one well daily. But they had to throw that sobriquet away, for in February of this year his division hung up an all-time record in the company's history with 67 completions—more than two a day.

Jules E. Toussaint, formerly general manager of operations in Standard's producing department and recently appointed general manager of the department, joined the company 23 years ago as a construction assistant. He had just graduated from University of California with a B.S. in mechanical engineering. He became in turn a draftsman, engineer and assistant chief engineer at the Richmond refinery.

Transferred to the San Francisco headquarters, Toussaint was named manager of the producing department's organization and cost-control division. Later he went to Los Angeles as assistant general superintendent of the producing department's southern district. He returned to San Francisco in 1940. It was there, in the latter part of 1943, that he earned the title of "One-a-Day." In 1944 his staff broke the world's deep-well record by drilling KCL 20-13, in the Coles Levee field, to 16,246 ft. before it was abandoned.

Bart A. Myers, vice president of International Petroleum Co., Ltd., Toronto, Canada, celebrated his 42nd anniversary with the Jersey company and its subsidiaries June 1.

David L. Frawley, vice president of Barnsdall Oil Co., has been elected a director of Pennsylvania-Central Airlines.

John Murrell, associated with the consulting firm of DeGolyer, McNaughton & McGhee, Dallas, and a member of the Petroleum Reserves Corp.'s technical oil mission to the Middle East 18 months ago, was guest speaker before the Tulsa Nomads last week. He reviewed the entire Middle East oil situation and warned that almost unbelievably large reserves and low-cost production will bring Eastern Hemisphere petroleum into postwar competition with oil from the western world.

Dr. Lester M. Goldsmith, chief engineer of The Atlantic Refining Co., has been elected chairman of the Philadelphia section, Society of Naval Architects and Marine Engineers.

Col. Walter C. Pew, American head of the petroleum section of the SHAEF mission to France, has been awarded the Legion of Merit for "pioneer work in large-scale personnel administration." Colonel Pew was general sales manager and a director of Sun Oil Co. when he volunteered for Army duty in 1942 and was commissioned a major. The citation says his work has "brought about a sound, well-organized personnel program for the Ordnance Department." He started with Sun in the Texas oil fields following his graduation from Massachusetts Institute of Technology in 1922.

Winston C. Allen, Columbus, Ohio, for the past 3 years associated with Petroleum Administration for War in Washington and now chief of the petroleum development section of the production division, has been admitted to practice before the Supreme Court of the United States.

Henry Schweer, independent geologist and oil operator of Oklahoma City, and **George P. Hardison,** district geologist for Shell Oil Co., Inc., in North Texas, have formed a partnership, Schweer & Hardison, as consultants in Oklahoma City. Schweer spent 18 months overseas with the Eighty-sixth Bomb Group, North African Photo Reconnaissance Wing and Thirty-sixth (Texas) Infantry Division and was relieved from active duty last December.

H. I. Duguid, who was senior engineer at the Cactus plant of Shell Oil Co., Inc., has been advanced to acting chief engineer, and **C. L. Hedman,** who was assistant chief engineer at the Shell Point plant, has been transferred in the same capacity to the Cactus plant.

R. W. Beatty, formerly assistant superintendent of the Tomball, Tex., gasoline plant for Humble Oil & Refining Co., has been appointed assistant superintendent of the Katy, Tex., gas cycling plant. Beatty, a Rice Institute graduate, joined Humble in 1933. He has been active in the construction and operation of the Conroe natural-gasoline plant and served as superintendent of the Dickinson gasoline plant.

David S. Frank, formerly superintendent of Pure Oil Co.'s refinery at Cabin Creek, W. Va., became superintendent of the Toledo, Ohio, plant June 1, succeeding **Harold L. Smith,** who has been granted leave of absence on account of ill health. **Clifton W. Cooper,** superintendent of Pure's refinery at Newark, Ohio, takes Frank's place at Cabin Creek. Frank has been with Pure 14 years, during much of that time assistant chief combustion engineer on the refinery control board. He graduated from University of Wisconsin with a degree in chemical engineering. Cooper, who joined Pure in 1933, formerly served as chief chemist at Cabin Creek. He graduated in chemistry from Lawrence College.

D. S. FRANK

C. W. COOPER

Mercoid is the answer to THE OIL INDUSTRY'S CONTROL PROBLEMS

Explosion-Proof Controls

EXPLOSION-PROOF PRESSURE CONTROL

EXPLOSION-PROOF TEMPERATURE CONTROL

The oil industry assumes major responsibilities in looking after the nation's unprecedented requirements during war emergencies.

In the midst of high pitched activity, there is a demand for safety measures all along the line. There is no time for taking chances.

Mercoid Controls have a wide application in the oil field, among which are the protection of costly bearings, maintaining liquid levels and various other problems involving the control of temperature and pressure. Wherever hazardous conditions prevail, Mercoid Controls encased within Explosion-Proof Housings are extensively used.

Mercoid Controls are especially suitable for oil field applications, because mercury switches are used exclusively. A Mercoid switch is not subject to open arcing—the contacting surfaces are hermetically sealed within a glass tube where they are protected from all outside adverse conditions. They are not affected by dust, dirt or corrosion. There is no such thing as pitting or sticking of contacts, thus assuring better control performance and much longer control life.

Whatever your control requirements may be, it will be to your advantage to specify Mercoid.

Our engineering staff will cooperate whenever you have a control problem.

A complete catalog mailed upon request.

THE MERCOID CORPORATION • 4205 W. BELMONT AVE. • CHICAGO, ILL.

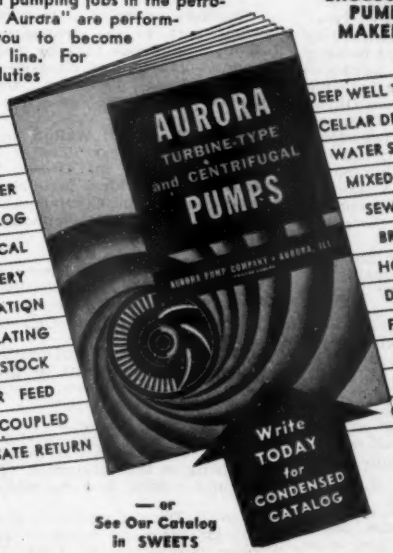
PUMPS YOU CAN TRUST

BUILT by EXCLUSIVE PUMP MAKERS

On the broad variety of essential pumping jobs in the petroleum industry, many "PUMPS by Aurora" are performing excellently. We invite you to become acquainted with this complete line. For many of your most exacting duties you'll find Aurora has just the pump you are seeking.

WE BUILD OUR PUMPS *in the* BELIEF *that* EVERY PUMPING JOB *is* IMPORTANT

SUMP
BILGE
TRANSFER
NON-CLOG
CHEMICAL
REFINERY
DISTILLATION
CIRCULATING
PAPER STOCK
BOILER FEED
CLOSE-COUPLED
CONDENSATE RETURN



DEEP WELL TURBINES
CELLAR DRAINERS
WATER SYSTEMS
MIXED FLOW
SEWAGE
BRINE
HOUSE
DAIRY
FARM
AND
MANY
OTHERS

— or See Our Catalog in SWEETS

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

74 Loucks Street, AURORA, ILLINOIS

ORBIT VALVES

DRILLING VALVES ARE QUICK OPENING

ONLY 2½ to 5 TURNS ARE REQUIRED TO FULLY OPEN OR CLOSE THE ORBIT DRILLING VALVE. THE SEATS ARE PROTECTED AGAINST DAMAGE FROM DRILLING TOOLS AND WIRE LINES

Orbit Flanged End Drilling Valve

ORBIT DRILLING VALVES ARE AVAILABLE IN BOTH FULL OPENING AND NOMINAL OPENING SIZES. WITH FLANGED OR SCREWED ENDS.

See 1944 Composite Catalog

SERVICE REPRESENTATIVES

R. G. "Bob" Cole, Houston, Texas
Phone Fairfax 0057
Warehouse 407 Velasco Street
Houston

Earl F. Warren, Phone 919-W, Alice, Texas

Rex E. Galloup, Phone 6436, Lubbock, Texas

ORBIT VALVE COMPANY

TULSA, OKLAHOMA

ING. A. CHAPA

G. P. GREGORY, JR.

C. G. COX

E. A. WALCHER

W. BRONKIE

R. H. DeMOTT

J. K. BEESON

R. E. KIRBERGER

J. W. WHALEN

Equipment Men in News

Ing. Amado Chapa will represent in Mexico, the companies represented by E. L. Carter and D. T. O'Connor, namely: Shaffer Tool Works; W. C. Norris, Mfr.; Frank Wheatley Pump & Valve Mfr.; Tulsa Boiler & Machinery Co., and Ben F. Kelley Co.

George E. Failing Supply Co., Enid, Okla., and Houston, announces the appointment of **G. P. Gregory Jr.** as export manager. An office has been established at 30 Rockefeller Plaza, New York City.

C. G. Cox has been appointed to the executive staff of Joshua Hendy Iron Works, and will serve as administrative assistant to A. A. Browne, manager of engineering and sales. Cox was formerly vice president and general manager of Enterprise Engine and Foundry Co. of San Francisco.

Edwin A. Walcher, vice president, Ohio Steel Foundry Co., Lima and Springfield, Ohio, was presented with the newly created Technical and Operating Medal of the Foundry Society of America for the year 1944. This medal, which was established in late 1944, is awarded annually to the individual adjudged to have made the most outstanding contribution toward the advancement of the technical and operating development of the industry during the preceding year. Other members honored were **Oliver E. Mount,** vice president, secretary, and treasurer, American Steel Foundries, Chicago, and **Claude L. Harrell,** vice president, Sterling Steel Casting Co., East St. Louis, Ill. Mount, retiring president, was presented with an embossed and illuminated scroll, and Merrill was presented with the Frederick A. Lorenz Memorial Award for having made the most outstanding contribution to the general welfare of the industry during the year.

Willis Bronkie has been appointed to the engineering and sales staff of the Victaulic Co. of America. He will make his headquarters in the main office of the company at 30 Rockefeller Plaza, New York City.

This year **Richard H. DeMott,** vice president in charge of sales, SKF Industries, Inc., Philadelphia, is observing his 30th anniversary at the company. He joined SKF in 1915 at its 50 Church Street, New York City, office, and when the company built its manufacturing plant in Hartford, Conn., he stayed on as New York sales manager. Promotions quickly followed as district sales manager, manager of industrial development, assistant sales manager, general sales manager, and finally vice president.

President **Joseph H. Carter** of Pittsburgh Steel Co. has announced the election as executive vice president of **Lt. Col. John Kennedy Beeson,** who recently completed his duties with the United States Strategic Air Forces in Europe. Colonel Beeson is the son of the late Charles E. Beeson, one of the original founders of the company.

One of the newest appointments in Franks Manufacturing Corp., of Tulsa, elevates **R. E. Kirberger,** assistant sales manager for the past year, to the post of sales manager. Kirberger has been with Franks for the past 13 years, beginning as a machinist.

John W. Whalen has been appointed chief engineer of Daniel Orifice Fitting Co., Los Angeles. He will have complete charge of all engineering details.

Mrs. Milo E. Smith was sponsor of the U. S. S. Krishna and christened the ship in launching ceremonies on May 25 at the Navy shipyard operated by Chicago Bridge & Iron Co. at Seneca, Ill. Mrs. Smith's husband, who is advertising manager of Chicago Bridge & Iron Co., served for a year when the shipyard was built in 1942 as the company's representative to cooperate with various federal agencies in the establishment of offsite facilities such as housing, schools, water system, roads, etc., to serve the shipyard.

D. E. Johnson, superintendent of the Caripito, Venezuela, refinery of Creole Petroleum Co., will be in the United States for the remainder of the year, taking a refresher course and familiarizing himself with new developments in refinery technique.

Briggs Clarifier Co. has announced the appointment of **Charles W. Miller, Jr.,** as a member of the engineering staff.

A change of policy brings all of the activities of product designing, engineering, manufacturing, sales and distribution under the one roof of the Clark Manufacturing Co., Cleveland, Ohio. From now on the company's products will be sold as "Clark Fluid Controls." The concern henceforth will maintain its individual identity, and will deal directly with its distributors and customers on a nation-wide scale.

Shand & Jurs Co., manufacturers of petroleum tank fittings, has moved its Chicago offices from 310 South Michigan Blvd., to Suite 813 in the Marshall Field Annex at 25 East Washington Street. **Robert Blake** is in charge.

Fred Thilenius, Tulsa equipment dealer, announces that his company has been selected to represent the complete line of Staynew filters for air, gases, and liquids manufactured by Dollinger Corp. of Rochester, N. Y. Representation includes the state of Oklahoma.

Workers of Standco Bolt Co., Houston, Tex., took an important part in the celebration marking completion of the 10,000th amphibious tank by Food Machinery Corp., on May 14. Standco manufactured component parts of the "Water Buffalo," which has seen war action from Guadalcanal to Okinawa, and from North Africa to the Rhine.

George W. (Jack) Walton has assumed the post of manager of drilling machinery sales of International Derrick & Equipment Co.—one of the Dresser Industries—it is announced by **Ferguson Barnes,** Ideco general manager of sales. Walton's headquarters are in the Continental Building, Dallas, where he will be assisted by **Carl Engelmohr,** formerly advertising manager at Ideco's Beaumont plant.

R. E. F. Schmid has been named to succeed **W. G. Wood** as purchasing agent for Continental Supply Co. Wood resigned his position with Continental on May 1, to join Champion Machine & Forging Co., Cleveland, Ohio.

Allis-Chalmers Manufacturing Co., Tractor Division, announces the appointment of **Ernest Franks** in charge of sales of industrial wheel tractors and power units with headquarters at Milwaukee, Wis.

V. B. Nelson, consulting engineer, announces the opening of offices at 2132 Commerce Building, Houston, effective June 1, specializing in the calibration of pressure vessels, ships, barges, tanks and trucks, and the correlation of gaging media.

Ladish Drop Forge Co., Fittings Division, announces the establishment of an office at 115 North Old Orchard Avenue, Webster Groves 19, St. Louis County, Missouri, to serve the St. Louis territory. District manager is **Sam S. Sample,** formerly sales manager of Busch-Sulzer Brothers.

Eastman Oil Well Survey Co. announces the opening of an office in Victoria, Tex. In charge will be field service representative, **B. Frank Johnson.**

Joseph H. Hayden has been made vice president and **William H. Watkins** has been named controller and assistant treasurer of Hewitt Rubber Corp., Buffalo, N. Y.